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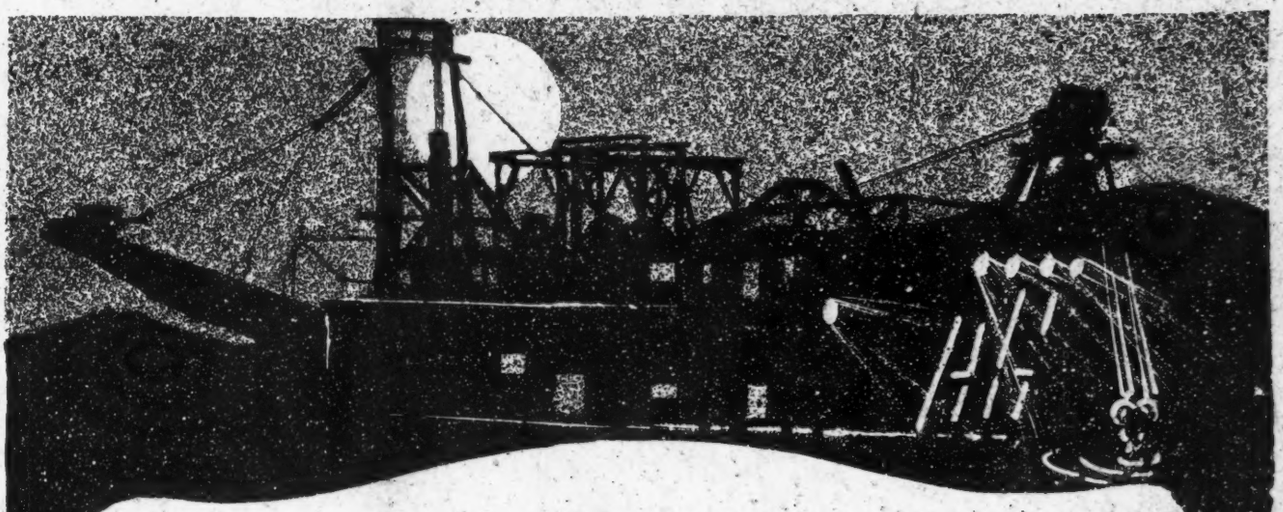
Engineering and Mining Journal

McGraw-Hill Publishing Co., Inc., New York



And there a giant gold-ship of the very newest plan
Was tearing chunks of pay-dirt from the shore.

It wallowed in its water-bed; it burrowed, heaved and swung;
It gnawed its way ahead with grunts and sighs;

Its bill of fare was rock and sand; the tailings were its dung;
It glared around with fierce electric eyes.

Full fifty buckets crammed its maw; it bellowed out for more;
It looked like some great monster in the gloom.

With two to feed its sateless greed, it worked for seven score,

The Prospector by Robert W. Service

"Fantastic though this description of 'The Kipling of the Yukon' is, it is far exceeded in fact by the remarkable performance of the big Yuba dredges, Yuba No. 17, which has a capacity of over 300,000 cu.yds. per month, does the work not of seven score, but of approximately ten thousand men with pick and shovel. Yuba No. 17 is the eighth Yuba dredge with 18 cu. ft. buckets. Our experience is at your service."

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DECEMBER 29, 1917

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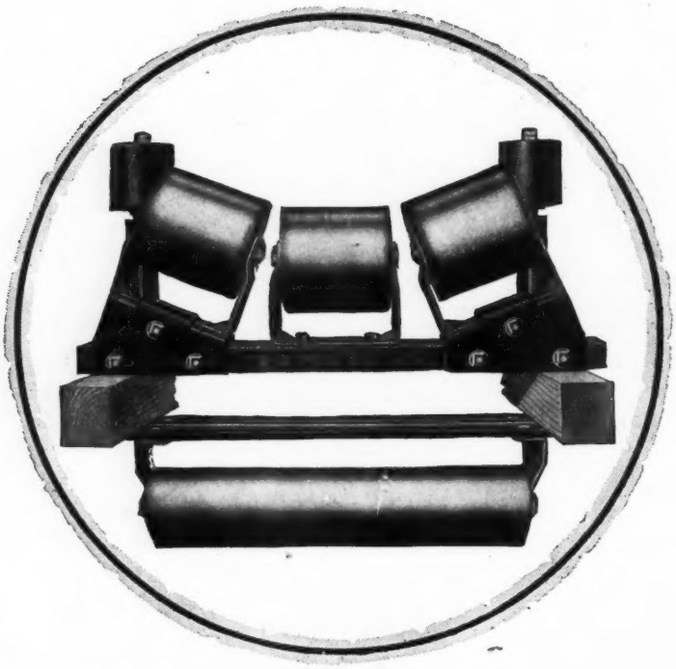

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Engineering and Mining Journal

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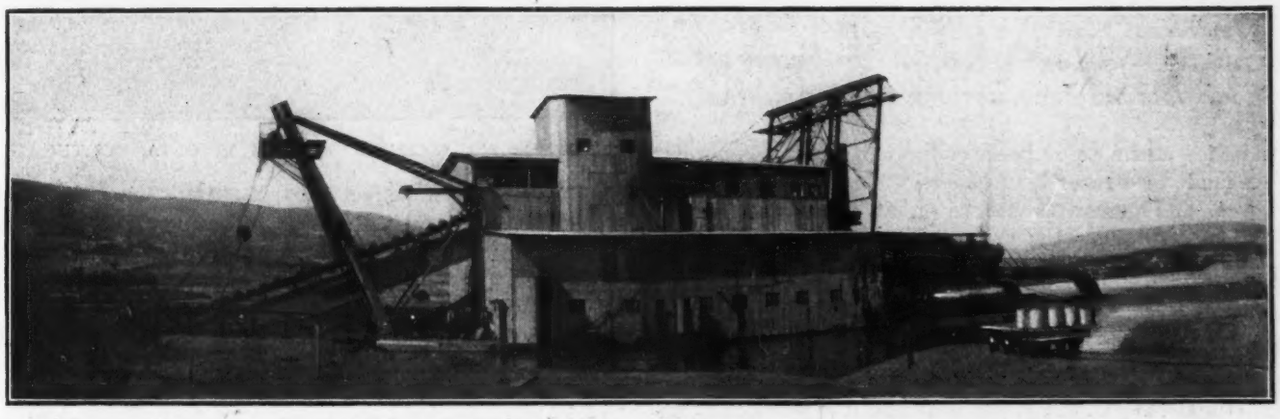
Tin Dredging in Portugal

BY FREDERICK W. FOOTE* AND RASTUS S. RANSOM, JR.†

The description of a successful American operation in Portugal. The dredge is operated by electricity generated by a wood-burning power plant. Electro-magnetic treatment of dredge product to remove ilmenite gives a first-grade product containing 74% tin.

THE Portuguese American Tin Co. has been successfully operating a dredge for four years at Guia, Portugal. Controlling stock in the company is held by Californians, who also have extensive wine interests in Portugal, and the dredging operations are carried on by gold dredgers from Oroville, Calif. The tin deposit occurs in a broad valley on the eastern side of the Sierra Estrella Mountains in the east-central part of Portugal. The deposit is several hundred meters wide, and continues for a distance of 4 km. in length. The actual veins from which the occurrence was derived have not been proved, but numerous lodes in the neighboring mountains are assumed to be the source.



ALL-STEEL DREDGE OPERATING IN TIN DEPOSITS OF PORTUGUESE AMERICAN TIN CO. AT GUIA, PORTUGAL

In working the deposit, an all-steel dredge designed by H. G. Peake and built by Fraser & Chalmers, Ltd., is used. This dredge has 4-cu.ft. buckets having a digging capacity of 80 to 90 cu.yd. per hour, a treatment capacity of 40 to 50 cu.yd. per hour and can dig to a depth of 24 ft. Recovery of the tin is accomplished in the following manner:

The buckets empty into a large revolving trommel with ½-in. round holes. The oversize is carried to the stern of the dredge by a traveling belt. Any material that does not fall into the trommel is caught in a hopper and passes to a sluice on the lower deck. The undersize from the trommel is split between eight sluices, each 33 cm. wide and 15 cm. deep, which run the full length of the dredge and extend about 4 m. over the stern. These sluices are provided with removable iron riffles built in sections of seven riffles, 1⅝ in. deep and 2½ in. apart. In ordinary operations only six sluices are in constant use, the two others being in process of cleaning.

When a sluice is clean it is "cut in" and another "cut out" to be cleaned. The material from the sluices is shoveled into a hopper and passes to a second smaller trommel with ¼ in. and 2½ mm. screens. The difference in units is caused by the fact that the dredge was built in England and replacements have been made on the Continent, where the metric system prevails, the nearest metrical equivalent being adopted. The sized material is then jigged in Harz jigs, and the jig product is carried ashore and washed by the native method, which consists of emptying the material into a deep and slightly inclined launder through which a strong current of water is flowing. The mineral is mixed by hand against the flow of water, and the fines are lost.

It would seen that the method of treatment could be improved by discarding the sluices and replacing them with tables, for first cost should be small compared to the additional saving that would result. Considerable experience with the native method, as applied to tungsten ores, demonstrates the losses involved by that system of treatment. Another improvement not involving large first cost would be to screen out all the material through 1¼-mm. impact screen and sluice only the plus 1¼-mm. size, treating the minus 1¼-mm. size on tables. The dredge would be able to handle more material, the losses in fines would be less and sluicing more efficient.

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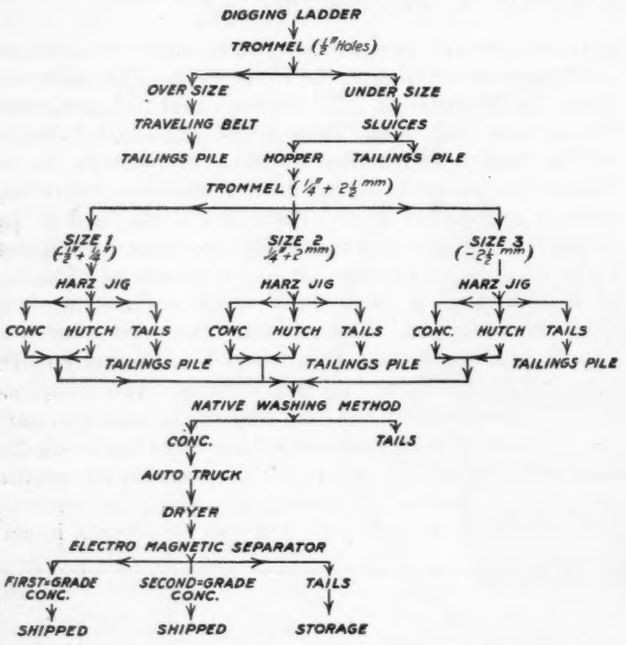
†Metallurgical engineer, James Ore Concentrator Co., Newark, New Jersey.

The company does not employ a chemist so it is impossible to give figures as to the grade of material treated and percentage of recovery.

The dredge is electrically operated, power being supplied from a plant owned by the company at Belmonte, 13 km. distant, and transmitted over its own power line to the dredge. The company's offices, machine shop, garage, etc., are situated near the dredge. The town of Belmonte is on the railroad, 350 km. from Lisbon, and affords a convenient means for bringing in fuel and shipping out tin concentrates. The power installation consists of a Babcock & Wilcox horizontal boiler that



FLOW SHEET OF OPERATIONS AT GUIA, PORTUGAL

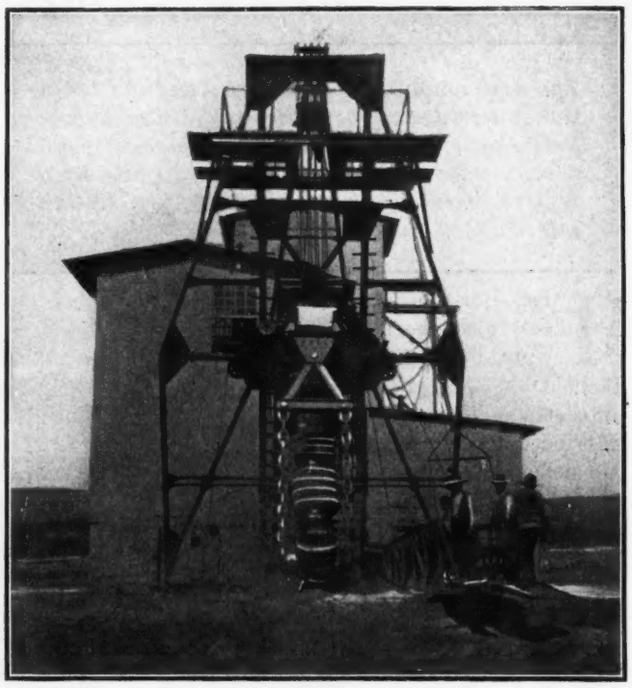
supplies steam to a direct-connected turbine generator set made by Fraser & Chalmers. This operates at 3600 r.p.m. and generates 315 kv.-a. at 6600 volts and 60 cycles. On shore the current is stepped down to 440 volts and used in separate motors as follows: 75 hp. for the digging ladder, 25 hp. for the jigs and screens, 85 hp. for the pumps and 15 hp. for the side lines, by means of which the boat is moved.

The price of coal has reached a prohibitive figure in Portugal ($66 U. S. Cy. per ton) and it is practically impossible to obtain it, so wood is used as fuel at present. Some wood is supplied locally, being brought in by bull carts and pack trains, and some is shipped in by rail often coming from as great a distance as 100 kilometers.

The finishing plant for producing the final tin concentrates is in a building adjacent to the power plant. Waste gasses from the boilers pass through a horizontal chamber above which is a sheet-iron plate on which the product from the hand washing plant is dried. The dried product is then fed to a Wetherill magnetic separator to remove ilmenite from the cassiterite. This machine makes a good separation and produces a 75% grade of tin which is sacked and shipped from Belmonte. The ilmenite is stacked in a waste pile awaiting a possible market.

The company maintains an American staff of manager, superintendent, one dredge master, three shift bosses, three winchmen and a bookkeeper. A company house, containing offices downstairs and a bunk house upstairs, is provided in addition to the manager's house and garage. The company has supplied an auto truck, two automobiles and two motor cycles. Estimates indicate sufficient material to last about four years and no further operating difficulties should be encountered.

In 1914 the production of tin concentrates was 172.29 metric tons averaging 68% Sn. In November, 1917, the company was producing about 60 metric tons of 74% concentrates a month. The 1914 production was obtained from the treatment of 169,577 cu.m. of alluvium or the recovery of 1.01 kg. per cu.m. The following



FRASER & CHALMERS DREDGE AT GUIA, PORTUGAL

wage scale was in effect during 1914. Superintendent 1500$000,[1] engineer 1200$000, bookkeeper 480$000, guard 146$000 a year. Native employees receive: Carpenters 1$070 a day, blacksmiths 0$900 a day, laborers 0$400 a day, and women 0$240 a day.

Manganese Ore Movement

During nine months ended Sept. 30, 14 states shipped[2] 70,225 tons of manganese ore containing 40% or more Mn. and 380,169 tons of 15-40%. Seven states shipped 424,438 tons containing 5-15% manganese.

Manganese ore imports into the United States in September were 36,755 gross tons, the lowest for any month this year except April. For the nine months ended Sept. 30, the total imports were 469,222 tons in 1916, and 494,633 tons in 1917; an increase of 25,411 tons. The total this year was sufficient to make about 180,000 tons of 80% ferromanganese.

Manganese ore exports from Brazil for the half-year ended June 30 are officially reported at 245,088 gross tons, against 240,090 tons in the first half of 1916; 102,870 tons in 1915; 88,500 in 1914 and 46,900 tons in 1913.

[1]The dollar sign ($) in Portugal is written between the "escudo" and the "reis," as 5$500 reads five escudos, 500 reis. The escudo was in November worth about 70c., par being one dollar.

[2]U. S. Geological Survey estimates.

Sampling of Mine Floors

BY ALBERT G. WOLF*

Floor sampling presents many working difficulties which increase with the wetness of the mine. Large flows of water may be temporarily diverted from sample cuts by ditches, pipes, flumes and small dams, and seepage into sample cuts lessened by trenching through loose floor material, assisted by bailing in adjacent trenches above stream. Floor sampling should be avoided where roof or wall sampling is possible, although a few floor samples should be taken for inspection purposes.

SAMPLING mine floors is hard and unpleasant work, and because of inaccuracies involved, is to be avoided where the necessary samples can be obtained from the walls or roof. In floor sampling it is difficult to catch all the fines and keep the sample free from mud or other floor material, to which is added the impossibility of inspecting the vein carefully before sampling without, in some cases, a prohibitive amount of preliminary work. Further difficulties not involved in sampling walls or roof are: Diversion of water flow, removal of loose floor material, tearing up and relaying of track, and sometimes the additional hardships attendant on the necessity of doing the work without interferance with regular mine operations.

CONDITIONS WHERE FLOOR SAMPLING IS NECESSARY

Sometimes, however, it is absolutely necessary to sample mine floors; for example, on a level where the ore is stoped out above; where the drift is tightly timbered; in the floors of underhand stopes; in the bottoms of winzes and shafts, and on outcrops. As to the probability of inaccurate results, this disadvantage is counterbalanced somewhat by the fact that generally the samples are taken from places in the mine where only "probable ore" could be estimated, and not "proved ore," "positive ore," or "ore blocked out," and due allowance must be made in basing any estimate upon such samples.

Workings to be sampled may be classified under two heads, dry and wet. The difficulties and inaccuracies involved in the latter are much greater than in dry mines. By the term "sampling," is meant cutting the ore by hammer and moil.

In dry mines, the chief difficulties are those arising from catching flying sample particles, removing track and loose floor material and, in a mine in operation, conducting the floor sampling without interfering with regular work. The only chances for error involved in sampling a dry floor are in catching all the flying particles, gathering the fines from the bottom of the cut, and preventing extraneous floor material from rolling into it. Catching flying particles is not nearly so difficult in roof or wall sampling, as the particles fly in a general downward direction and can be caught in a box or canvas basket held close to the point of cutting, or by a large canvas spread on the floor; although with the best precautions many pieces fly astray. In sampling floors, the chips fly upward and outward in every direction. To catch these, it is best to place one canvas across the line of cut, just ahead of the point of cutting, and one on each side of the cut. If a deep preparatory trench has to be cut through loose muck on the floor, it should be made wide enough to keep extraneous material from rolling into the sample groove, and the canvas should be pressed down into the trench ahead of the point of cutting. A box held a foot or so above the moil and just ahead of that point, will act as a baffle, preventing the particles from flying too far and causing them to fall back upon the canvas. When one-half the sample has been taken, the canvas should be laid on the other side, and the second half of the cut made, always keeping the canvas close up to the point of cutting. A stiff brush will be necessary to aid in gathering up all the fines.

WATER CONTROL IN FLOOR SAMPLING

In addition to the difficulties already enumerated, in wet mines mud and water must be overcome. In the first place, the main flow of water must be bypassed, so as to make sampling at all possible, and secondly, seepage must be minimized in order not to contaminate the sample with mud.

Obviously, in sampling the floor of a wet mine, handling the water is the chief problem, and the accuracy of the work will depend upon the precautions taken. In the preliminary sampling of a small property, it would be too costly to take all the precautions that might be enumerated. In such a case, where the vein is narrower than the drift, the water can be run through a ditch at one side of the drift, or if the vein is too wide to permit this, the water can be passed across each trench in the loose floor muck by means of a launder or piece of air pipe a few feet in length. In this way, by bailing out the seepage a few times while moiling is in progress, it is possible to get a sample with the least expenditure of time and effort. The sample, it is true, will be somewhat subject to inaccuracies, either on account of mud carried into the cuttings, or, if the cuttings are washed free from mud, by the loss of fines. This is a makeshift method, and justifiable only on a preliminary examination where the necessity for greatest accuracy does not warrant expenditure of more time and money.

In more important examinations, greater care must be taken. If the water in a drift comes from one or a few chief sources, down certain raises or chutes, for example, it can be carried past the working point in launders or pipes. If this is done a day or so before the sampling is started, the loose floor material will have drained to such an extent that seepage into the trenches will be little. On the other hand, if the water comes from a general percolation through the vein, the use of dams must be resorted to in order to collect it, and launders or pipe used to carry off the water from behind the dams. If a level is extremely wet, a dam will have to be built for each short length of drift sampled. For example, beginning at the lowest point

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of a level, which would be (or should be) where it connects with a shaft, crosscut, or other main working, a dam should be built across the drift about 100 ft. distant. This dam can be easily made with a couple of 2 x 12-in. planks, superimposed edgewise, and fitting snugly against the floor and walls. It should be made as nearly water-tight as possible by calking, or tamped with clay, cement, talc or any fine-grained impervious material. The launder or pipe should lead from the upper half. The dam should be only high enough to give a slight grade to the launder with enough elevation to carry it over irregularities in the floor. If the dam is too high, the hydraulic pressure will be such as to cause water to leak through so crude a structure.

With the dam in place, the main flow of water is cut off, and trench digging and sample cutting can proceed. If the inflow of water along the vein is large, it may be necessary to have the dam quite close to the point of cutting, for otherwise the trench may fill with water so fast as to require constant bailing. The seepage into a trench may sometimes be greatly lessened by digging auxiliary trenches above the sample trench, and bailing from them. In some cases, the removal of all loose floor material, instead of just digging trenches, may be necessary to prevent too great an infiltration of mud into the sample cut.

Comparative Advantages of Pipe and Flume

The methods of conducting water flow are by pipe and flume. Each system possesses advantages not to be found in the other, the greatest advantage being in favor of the flume, especially under certain conditions, which will be described. Light, galvanized-iron air pipe is easier to handle and put together, and in a straight drift with no branch openings conducting tributary water, is to be preferred to a flume, if the material is immediately available. The flume, while heavier than the pipe, and more trouble to put together, has the following advantages: It can be cut up into short lengths in order to make turns; it is open at the top and can be bailed into, which is a great advantage when more than one cut is being made at the same time, as the bailed water is conducted away instead of running down into the next lower cut; and if a crosscut is adding water to the flow in the drift, a second cut can be built across it at the intersection, and a short flume used to carry the water collected into the main flume.

Catching the cuttings is the chief difficulty in sampling wet floors. A canvas cannot be spread over the floor and down into the sample trench as with dry floors, because the seepage would carry upon it a great deal of mud. Some engineers suggest washing the sample to eliminate this infiltrated mud, but that would cause a loss of fines from the cuttings as well. The best way to catch the cuttings is to hold a canvas sampling bucket, or a conical "butterfly-net" sample catcher, close to the bottom of the trench and a few inches in advance of the moil point, with the opening of the receptacle in a vertical position. The circular shape of the bucket opening permits either to get closer to the floor in the bottom of the trench than is possible with a box.

Two other errors are involved in sampling wet floors. One, the obscuring of the work by dirty seepage, making it impossible to be sure that a uniform cut is being taken; the other, the concentration of rich fines into floor cracks by the action of running water, causing high assay samples. The first cause of trouble has been dealt with; the second can be guarded against by making a preliminary cut across the vein and rejecting the material before making the regular sample cut. If error from this source is expected, the rejects from a few preliminary cuts should be assayed with the regular sample cuts as a check or confirmation, before going to the trouble of making further double cuts.

Floor Sampling as a Precautionary Measure

Although floor sampling, where it is possible to take roof or wall samples, is not to be recommended, frequently it is advisable at least to examine the floors as a precaution against estimating ore where there may have been underhand stoping, especially if it is an old mine that has been badly gouged. For example, at a certain mine that was examined, the maps showed no stoping below the lower tunnel level. An oreshoot several hundred feet long had been opened on this level a number of years previously. Before any appreciable amount of stoping had been done, a report was made on the property by an engineer of prominence. Subsequent to that examination, considerable ore was stoped above the level, all of which was shown on the maps submitted by the owners. Most of the stopes were accessible, and the backs were sampled. Now, as the drift had been sampled by an engineer of unquestioned ability and reputation before stoping had started, it would appear safe to take his results in estimating the grade of probable ore below the drift. However, it was decided to take some floor samples at rather wide but regular intervals, as a check, even though the difficulties were great on account of a heavy flow of water along the vein and much loose material on the floor.

At one part of the drift the depth of muck grew steadily greater up to 3 ft., an extraordinary amount of filling. At this point, when no bottom was struck at a depth of 3 ft., a long drill was driven down into the loose material without touching bottom. Evidently there had been an underhand stope, the existence of which had not been mentioned by the owners or suspected by the examining engineer. The length of this stope, which proved to be of considerable extent, was determined by digging pits followed by driving down long drills. The depth could not be determined without hoisting a large quantity of material, which was out of the question in an examination of that nature. From either end of the drift the samples showed increasing assay values up to the point where the stope started, so that it was evident a high-grade shoot had been gouged. The uncertainty of the depth of this stope and the secrecy maintained regarding its existence manifestly reduced the value of the property, its value becoming dependent largely upon the possibility of opening other orebodies below the existing level by a new adit.

German Metal and Munition Companies are being organized in Berne, Switzerland, according to *Echo des Mines*, three companies having recently been organized, known respectively as Metallum, Militaria and Neutrale. Their object is to conduct metallurgical and electrometallurgical operations, and the intention is evidently to work after the war is ended. It is understood that the organizations are controlled by the Metallgesellschaft of Frankfort, and the Allgemeine Elektricitats Gesellschaft, of Berlin.

Design and Construction of Bucket Elevators

BY ROY REDDIE*

Bucket elevators cannot be standardized to meet all conditions. Modern American mill practice leans toward the bucket-and-belt type for the elevation of a crushed wet pulp. The size, shape, and spacing of buckets, belt speeds, size of head pulley, quality of belt, and method of bucket discharge are all factors that govern the working efficiency of a bucket-and-belt elevator, and should be taken into account in mill design.

THE elevation of crushed ore and pulp is a problem of considerable moment in modern mill practice. In the past engineers have often overestimated the advantages of a gravity-slope mill site. Where steep gradients necessitate arduous climbing back and forth, mill machinery is likely to suffer from lack of attention, which would not be the case, from the cause mentioned, at least, were the mill floor level.

Pulp may be elevated by various devices. Pump and tailing wheels are used on the Rand, at Waihi and a few Kalgoorlie plants; plunger pumps are employed at Bendigo and centrifugal pumps at Tonopah. Working in fields widely separated, the millmen of Broken Hill, Australia, of Idaho and Missouri, as well as many other districts in the United States, show a preference for the bucket-type elevator. Opinions differ as to the respective merits of pumps, tailing wheels or bucket elevators for elevating sand, pulp or slime, but I hazard the assertion that the elevation of pulp crushed to a jig-feed size, or coarser, can be accomplished at less cost by the bucket elevator than by any other device in use at present.

BUCKET ELEVATORS IN THREE CLASSES WITH FOUR TYPES OF DISCHARGE

Bucket elevators may be divided into three classes: (1) Single-chain; (2) double-chain and (3) belt-and-bucket elevators. Each of these may, according to the manner in which the delivery of the pulp takes place at the top of the elevator, be subdivided into types as follows:

Centrifugal-Discharge Type: Such elevators are driven, as the term implies, at a speed adequate to cause discharge by centrifugal force. The buckets are spaced far enough apart so as not to interfere with the discharge.

Continuous-Discharge Type: In this type V-shaped buckets are used. They overlap slightly on the belt and are provided with sides extending outward from the outward leg of the V in such a way that a chute is formed by the outside of the buckets for the pulp of the next succeeding as they are inverted over the head wheel.

Positive-Discharge Type: Buckets of this class are bolted between two chains which, upon passing the head sprockets, are deflected backward at an inclination from the vertical, by leading them over two knuckle sprockets placed just below the head sprockets, and the buckets are inverted over the receiver with a clean and comparatively gentle discharge. The buckets may be spaced or continuous. This type is adaptable for handling friable material which would be likely to produce considerable dust if thrown from a centrifugal-discharge elevator.

Gravity-Discharge Type: This is a combination elevator and conveyor. On passing the head sprockets the buckets move away on a horizontal path until the receiver is reached, where they pass over another sprocket and discharge their loads by gravity.

CHAIN CONVEYORS NOT POPULAR WITH MILLMEN FOR WET-CONCENTRATION WORK

Elevators of the double-chain-and-bucket type may be used to do any work within the scope of a bucket elevator, but mechanical considerations prevent single-chain-and-bucket or bucket-and-belt elevators from performing the functions of the positive- or gravity-discharge types. Chain or link-belt elevators are widely used to handle coal or other non-abrasive material, and also for ore and rock that has been dry-crushed, or the screened oversize from wet-crushed ore. Chain elevators are disliked, however, by wet-concentrator millmen. The detachable-link belt, invented by William D. Ewart, in 1875, was tried for bucket elevators, with the result that wet-concentrator millmen became prejudiced against its use. The articulations of the chains afforded such easy entrance to abrasive sands that the wear was excessive, and the number of articulations as well as the difficulty of inspection made replacement of wearing parts troublesome, tedious and costly. Bushed and riveted chains can, however, now be obtained especially designed to hinder the entrance of abrasive sands in the articulations, thus meeting to some extent the early objection.

The fact that good rubber belt proved more economical and satisfactory for elevator service than the detachable-link belt led many millmen to believe that the belt-and-bucket elevator had established its economic superiority over the chain elevator even for the elevation of coarse crushed rock from the preliminary crushers. Elevators in modern concentrators have to meet conditions so varied, however, that it is futile to expect all requirements to be satisfactorily met by a single type.

Chain elevators should be carefully designed and chains of ample strength provided to overcome that most prolific cause of rapid wear—weaving of the bucket line. To ensure requisite rigidity heavy buckets are needed, and these should be firmly bolted to the chain attachments. The area of the link connections should be such that the bearing pressure does not exceed the bearing strength of the metal, otherwise, and without the entrance of abrasive material, play will result and the deterioration of the chain will be rapid. An ample safety factor should be allowed. The chain tension and journal pressures under which slow-running elevators work are great, and if the buckets are to be loaded to 75% capacity, a chain having a safety factor of 1:15

*Metallurgical and mining engineer, Gratz, Ky.

is none too heavy. Roller chains should be used in heavy-service elevators, and these will also give greater satisfaction for elevators of the gravity-discharge type, as the friction on the horizontal run will be reduced to a minimum. Lubrication of the chain is important. Link-belt or any type of chain working on gritty material should be lubricated with graphite. The chain should be run with the back of the coupling hook to the wheel and with the teeth of the driving sprocket pulling against the curve of the coupling hook while the inner side of the cross bar from which the coupling hook extends should pull against the teeth of the driven sprocket.

Various types of sprockets and pulleys are used to carry the bucket line. Sprockets may be used at the head and at the foot of the elevator, or at the head with a flanged pulley at the foot; or a traction wheel may be used at the head and a sprocket or flanged pulley at the foot. A single-strand elevator should be driven by a traction wheel if the elevator is designed to handle gritty material. With a traction wheel the grip is ample for all the work the elevator should be called upon to do, and in the event of choking the chain will slip instead of breaking. Elevators driven by a traction wheel will run more smoothly and last longer than if sprockets are used.

Elevators are subject to violent shocks and in order successfully to withstand the destructive influence of such shocks it is well to allow a wide margin of safety by providing sprockets and wheels of ample strength to support the load and transmit the power required to move it. It is customary to use ordinary cast-iron sprockets for light work, but for heavy work it will be best to provide heavy chilled-iron or preferably cast-steel sprockets, which may be obtained with removable face or tooth segments fitted and held in place by T-headed bolts. The head sprockets of double-strand elevators should be keyed to the shaft with the teeth exactly in line. If sprockets are used in the boot one should run loose upon the shaft to keep the buckets level and to minimize wear. A bushing should be fitted in the hub of the wheel and a sleeve liner placed over the shaft. Bushings and liners are cheap and easily replaced when worn and will prolong the life of shaft and sprockets.

Flanged Foot Pulleys in Chain-Elevator Boots

The use of sprockets in the boot of an elevator is a fruitful source of trouble. If the chains become loose they are likely to ride off the sprockets; they also fail to give sufficient support to the buckets when dredging material from the boot. If the elevator is front-fed and the material that builds up under the buckets is shoveled out frequently the grinding effect upon the buckets will be considerably reduced, but the liability of the chains to ride off will always be present. These objections can be overcome by using a pulley having a deep flaring flange, and, for extra heavy duty, a light dredge tumbler, particularly if the buckets are intended to dredge their load. If long-pitch chains are used the head sprockets will be polygonal and they will in consequence impart pulsations to the chains, thereby greatly increasing the strain. To counteract these pulsations a device introduced by the Link Belt Co., which consists of an equalizing gear made up of a wave-line spur-gear and eccentric pinion may be employed to advantage. In it the number of elevations and depressions of the spur wheel equals the number of teeth in the conveyor wheel and the variations in chain speed exactly counteract the pulsations and eliminate the strains induced by running long-pitch chains over head sprockets. Another device, introduced by the Stephens-Adamson Manufacturing Co., accomplishes the same purpose. It consists of an equalizing gear in which an intermediate gear shaft is connected by eccentric links to the head shaft in such a way as to give it a varying motion in an inverse proportion to the velocity of the elevator chains.

I have used chain-drive transmission for elevators, and chain-driven and belt-driven gear transmission, and have found the direct chain drive the most satisfactory and noiseless for all elevators of moderate height. Low-speed heavy-loaded elevators should be belt and gear driven, so that, in the event of choking, the belt will slip and a breakdown be averted. If split sprockets are used for elevator drives, or for driving any other machine from a line shaft, the hub should be housed in, otherwise a "thrown chain" will be liable to catch on the hub and bend the line shift.

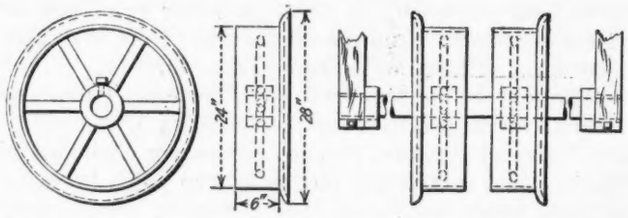


FIG. 1. DETAIL OF TWO-SECTION FLANGED FOOT PULLEY

Various Designs for Head and Foot Pulleys

As a rule cast-iron head or foot pulleys are to be preferred. Pressed-steel pulleys are sometimes placed at the head, but they should never be used at the foot. Cast-iron pulleys, keyed or hydraulically pressed on the shaft, are most satisfactory for head pulleys. Foot pulleys should be of cast iron secured to the shaft by setscrews. They are easy to replace and if the setscrews are provided with jamb nuts there will be no trouble from slipping. Head pulleys vary in diameter from 30 to 48 in., the diameter being determined by a compromise between two opposite conditions. Material that has a tendency to stick or pack in the elevator buckets will discharge at a lower belt speed if the belt is run over a small head pulley than if a large one is used; but if the belt is run over a head pulley of large diameter the internal friction of the belt will be less. High belt speeds tend to keep the material from packing in the buckets and this affects the discharge favorably, but high belt speed shortens the life of buckets, and their tendency to become misshapen and warped increases rapidly with the belt speed. Excessive internal friction will rapidly loosen and separate the plies of cotton duck, causing it to "boot-leg." From my experience with belt-and-bucket elevators I am of the opinion that a head-pulley diameter of from 36 to 42 in. will give best results and larger sizes may be used if the material handled is of such a nature that it will not pack in the buckets. The head pulleys of all belt-and-bucket elevators should be lagged. I have demonstrated to my own

satisfaction that lagging the head pulley will increase the life of the belt from 30 to 50 per cent. An 8-ply cotton belt is most satisfactory for lagging and should be secured to the pulley rim by ¼-in. small-headed elevator bolts pitched 4 in. on the pulley rim. It will be found that the cost of lagging a pulley will be negligible in comparison with the saving effected.

Various forms of solid-face and skeleton pulleys have been tried in the boots of elevators. Fig. 1 shows a type that I designed, and it is most satisfactory. On material crushed to 1 in. or less this pulley gives ample support to the buckets when dredging from the boot. The flared guides on the rims of the pulley keep the belt from running off, while the space between the two parts of the pulley minimizes the wear resulting from falling gravel caught between the belt and pulley. These pulleys should be cast heavy and be of hard iron. Shafts that carry the foot pulley should be comparatively light. A $2\frac{7}{16}$-in. shaft will be found heavy enough for most elevators. Head pulley shafts should be much heavier in order to insure proper rigidity under work-

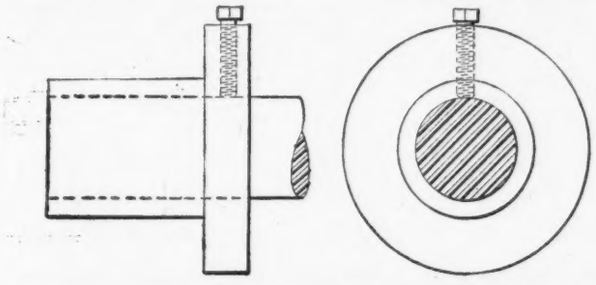


FIG. 2. DETAIL OF SHAFT COLLAR AND SETSCREW

ing conditions and be able to withstand heavy shocks without appreciable springing. The wear upon shaft journals is great and generally necessitates frequent renewals. To reduce this it is recommended that a cast-iron collar and sleeve be put on the foot shaft of all elevators, as shown in Fig. 2, using a samson-post take-up, and it will also be advisable to use a similar device upon the head-shaft journals of heavy-duty elevators in order to avoid the damage that may result from a broken head shaft.

Many mill fires originate from the overheating of elevator head-shaft boxes. To reduce this risk use a good grade of babbitt in these boxes and have them lubricated by positive-feed grease cups carrying a good grade of grease. If oil is used and poured into the boxes from a free-running oil can, sooner or later the bridge-trees and adjoining woodwork will become oil soaked, thus increasing the fire risk. In all dry-treatment mills special precaution should be taken to guard against fire at the heads of elevators, because a fire may gain considerable headway at these points before being noticed.

Rubber Belt Ply of 34-oz. Duck Not Too Heavy

Rubber, cotton, balata, leather, and anhydrous leather are all materials that have been incorporated into belt fabrication for elevator service. Opinions differ widely as to their respective merits, but rubber belting seems to be the favorite. A rubber belt is a fabric that is built up of lengths of cotton duck folded lengthwise, the number of the folds being the number of the ply of the belt. The plies are cemented together by what the trade terms the "friction," after which the outside cover is applied. The whole is then vulcanized under pressure, the degree of which depends upon the service the belt is designed to withstand. Three elements therefore influence the quality of a belt: The cotton duck, giving strength; the "friction," bonding the plies, and the rubber cover intervening between abrasive elements and the carrying fabric. Manipulation during manufacture varies according to the destined service of the belt. Elevator belts must be subjected to greater pressure than transmission belts, otherwise they will become soft and pulpy when water soaked and the bolts attaching the buckets to the belt will easily pull through the fabric. A 32-oz. duck is used in the fabrication of the better-grade belts; cheaper belts are made from lighter duck. It has been asserted that the "friction "cannot be forced through in quantity sufficient to uniformly bond together the different layers of cotton duck if the latter is heavier than 32-oz. material. However, I have it on the word of a manufacturer of repute that this is not the case. A well-known company puts a 34-oz. duck belt on the market said to be "frictioned and faced" with pure Para rubber. This belt has given good service under severe elevator duty and although it is high in price many millmen recognize its economy.

Transmission Belts Not Reliable for Elevator Service

As the strength of cotton duck, other things being equal, depends upon its weight, it is obvious that a heavier duck will make a stronger and, it may be, a better belt if the head pulley is big enough. This, of course, holds good only when experience on the part of the manufacturer has been applied to the fabrication of the belt. So many factors enter into the manufacture of a cotton belt that a heavy duck of loose texture and inferior cotton may easily be inferior to a lighter duck.

The quality of the "friction" will often vary within wide limits. It may consist of new rubber, or it may be a mixture of reworked rubber made from discarded rubber goods, in which case the result will be an inferior material. Reputable manufacturers use new rubber in their high-grade belts, but the ideas of each may vary as to the amount necessary and as to the proper thickness of the outside cover. A high-grade transmission belt may give poor elevator service. I have in mind an occasion when a transmission belt was used for this service and was worn out in two weeks' run. The maker's attention having been called to the poor service of his belt, and the conditions having been explained, he shipped a length of the same brand of belt after it had been specially treated to withstand the conditions of elevator service, and this piece lasted just thirteen months. This well illustrates the importance of considering the manufacturer's advice.

Do not buy cheap elevator belts; the best are none too good. Find out what belt has given good service, and if it continues to give satisfaction use that brand until complete proof is forthcoming that some other brand has given better service. The average user has no elaborate belt-testing plant, and samples are not always to be relied upon, as extra care is sometimes exercised in making them.

Some millmen rely upon the "friction" pull. This test is made by cutting strips 1 in. wide from a piece of belt and noting on a spring-balance the tension that is

required to pull the plies apart. It is, however, easy to be fooled by the "friction" test, as belts may be so made as to show a high "friction" test when new, but when they have been stored for a few months many rapidly develop upon usage as many schisms as the Church. The relative merits of different belts may be determined by splicing together lengths of different brands and then studying their behavior under actual running conditions. Satisfactory service, however, can be expected only when a belt made by a manufacturer of repute is used.

In order to get a line on the respective merits of cotton and rubber belts I made up a belt by splicing a length of a well-known brand of cotton belt to a rubber belt of repute. The result of this test was that the belts showed a likelihood of giving cent-for-cent value while running, but a loss occurred on the time the mill was shut down changing belts. Therefore, the belt that gave the longest service was the winner. For light service, however, cotton-duck belts are all right.

Balata belting has also been extensively used, but opinion is divided as to its worth. The cotton duck entering into its composition is not weakened by the vulcanizing heat applied to a rubber belt, and it is asserted that duck of equal weight is 20% stronger. The balata gum can be dissolved to the consistency of milk by proper solvents and will then pass through a much heavier duck than is possible for the "friction" of a rubber belt. It is extensively used in South Africa for conveyor belts, but millmen who have used it in America have failed to approve it unanimously for wet-elevator service. It should disclose a decided superiority to justify the difference in price over rubber belting.

An anhydrous leather belting is manufactured by the Iresen company, of Boston, Mass., and is especially made to withstand the wear and tear incidental to wet-elevator service. It is said to give superior service under any condition other than that produced by pronounced acidity of water. For wet-elevator service, anhydrous belts are made three-ply with the idea of turning the belt when the inside ply shows undue signs of wear. These belts have given good service under severe conditions but have not, so far as I am aware, established an economic superiority over rubber belting. Under certain conditions a cotton belt will give good service, but for heavy-duty wet-elevator work I hazard the opinion that a rubber belt made especially for this service by a manufacturer of repute will prove the most economical. There are various types of belt tighteners. I believe, however, that the one illustrated in Fig. 7 is the quickest and handiest for taking up slack.

V-Shaped Buckets with Rounded Bottoms Effective

The efficiency of a bucket elevator depends greatly upon the shape of the bucket used, and not alone upon its form when new, but upon its ability to retain it under the stress of working conditions. If the buckets are made from light material they will quickly become warped and misshapen before the wear has had time to become appreciable. Once the shape of the bucket is lost, the friction during loading will be excessive, the capacity reduced, and the ability to discharge cleanly impaired to such an extent that much of the material handled will be spilt back into the boot. An L-shaped bucket gives an ideal discharge but has little capacity. A deep bucket has large capacity but discharges poorly. Rounded corners facilitate delivery and as a compromise an elevator bucket should be V-shaped with rounded apex, having the front of the bucket cut lower than the back. Such a bucket has a fair capacity, retains its shape and discharges well. A U-shaped bucket that has a projection of the lip equal to its depth gives an ideal discharge, but soon loses its shape when handling coarse material. When a bucket of this type is made from a single sheet and pressed into shape without being lapped and riveted, the material should be of heavy gage if the bucket is destined to handle coarse gravel, otherwise it quickly becomes distorted. I have found, for instance, that a 6-in. x 14-in. 13-gage cup—a so-called heavy-ore cup—was an abomination when called upon to handle material up to 1-in. mesh, soon becoming so misshapen as to be useless. A malleable-iron bucket should be used to handle hot or corrosive materials, but the ordinary lapped and riveted sheet-steel bucket will be found most satisfactory and economical for handling wet-crushed ore.

For continuous-bucket elevators V-shaped buckets are preferred in order that the discharging material may

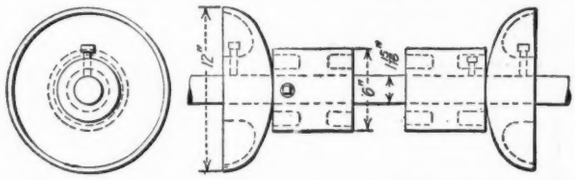


FIG. 3. DETAIL OF DISH-PAN TYPE GUIDE PULLEY

slide away over the outer sides of the inverted buckets into the receiver. They will not handle material that has a tendency to stick or pack, but are satisfactory for freely discharging substances. If the material be very abrasive it will be found advisable to use a bucket with reinforced edges. Buckets of over 14-in. length should have a reinforcing stay from the back edge to the front edge. This stay materially assists in retaining the bucket's shape and thereby prolongs its life. For wide bucket-and-belt elevators, buckets two-thirds the belt width set in staggered rows will minimize the strains to which the belt is subjected when endeavoring to conform to the pulley's crown. When buckets are thus staggered the millman is able to use a higher-crowned pulley than otherwise and reduce the risk of the belt running off. If buckets of full belt width are employed on wide belts it is advisable to use a flat-faced pulley, keeping the belt on with the assistance of a belt concentrator of the dish-pan type set just below the head pulley, as illustrated by Figs. 3 and 5.

Bolsters consisting of strips of old belt 1½ in. wide and of length equal to the depth of the bucket should be placed between the bucket and the belt. These bolsters allow a stream of water to flow downward between belt and buckets, washing away much of the grit that would otherwise lodge there, and reducing the cutting effect of the back edge of the bucket as it is thrown forward against the belt on passing the head pulley.

Capacious Concrete Elevator Boots Are Best

Elevator boots should be capacious to allow room for workmen to enter and shovel out the boot in the event of a choking. It is preferable to build the heavy-elevator boots of concrete in order to carry the superstructure, but a stout timber framing housed in by 2-in.

plank will serve if the joints are made tight in order to prevent leakage in or out.

Some manufacturers assert that the proper way to feed an elevator is to spout the feed into the ascending buckets. This may be true for slow-running elevators of the continuous-bucket type when handling dry-crushed rock from the preliminary breakers, but experience has taught that the wear and tear upon the elevator handling ore and water are just as great when so fed as when the load is dredged from the boot. Generally a housing should be provided. Slow-running bucket-and-chain elevators are sometimes built uninclosed, but it will be found safer and cleaner to house in the elevator, and such housing should be so roomy that inspection or entrance for repairs will be easy.

Construction Indicated for Special Requirements

The construction of an elevator that has proved satisfactory is shown in Fig. 9. The side under the receiver should be vertical if possible, in order that any material spilt back into the boot may fall clear of the belt. The opposite side should have a batter corresponding to the inclination given the bucket line. Fig. 6 illustrates the samson-post take-up, probably the most satisfactory device for taking up slack in the belt of an elevator. An elevator may be boxed in by nailing boards on the outside of the framing, if it is of the slow-running type or of any type that discharges free from spill; then when repairs are necessary a plank laid from header to header will provide a safe platform or staging for workmen. Wet-elevators and particularly elevators of the centrifugal-discharge type should have the boxing nailed on the inside of the framing or falling gravel will sooner or later cut it away. Build the top high enough to prevent splash going over. The height will depend upon the belt speed; usually 1½ times the head-pulley diameter will be sufficient. The hood may be open on the side opposite the receiver to facilitate inspection, but this will not be needed unless it has been necessary to build a high hood. For a light elevator, or for one that has not been equipped with a belt concentrator, to maintain the alignment of the belt the hood may be drawn in close to the belt, or guide boards as shown in Fig. 4 may be used. If the hood is covered see that this cover is of such a height that discharging material will not be thrown against it. If a roof is placed over the elevator it should be of sufficient height and strength to permit the use of a block and tackle in handling the running gear when repairs are necessary.

Receivers of large-capacity chain elevators handling dry material should be lined with cast-iron plates placed at an angle greater than the angle of repose for the material handled. The receivers of centrifugal-discharge elevators handling ore and water should be made the full width of the elevator-housing and extend in front for a distance equal to two-thirds of the head-pulley diameter, and the edge at the point of overflow should be several inches above the bottom of the receiver in order to allow a dead bed of material to accumulate in the box to protect the bottom from wear. The edges of the buckets should just clear the edge of the receiver.

Millmen differ in opinion regarding the drop that should be allowed from the top of the head pulley to the edge of the receiver. If the material handled has no tendency to pack in the buckets, it will be discharged into a receiver without spill, providing the edge is just level with the bottom of the head pulley and the speed is right. If, as is sometimes the case, the elevator is designed to work upon material that has a tendency to pack, it will be best to lower the edge of the receiver to a point 24 in. below the bottom of the head pulley.

Chain elevators may not be economically driven at the speeds that are customarily adopted in bucket-and-belt elevator practice. The larger sizes should be fitted with large, positively lubricated rollers and the speed should not exceed 100 ft. per min. The smaller sizes of positively discharging chain elevators may be run at a speed of 150 ft. per min. Light centrifugal-discharge elevators of the steel bushed-chain type are sometimes run at a speed of 300 ft. per min., but the wear at that speed is apt to be excessive. In the long run it will be found more economical to place the edge of the receiver from 12 to 24 in. lower than usual, than to run the elevator at an abnormally high speed in the effort to secure a clean discharge into a high receiver. It is better to elevate material an extra 18 in. on the initial lift than to reëlevate pulp that is steadily spilling back into the boot because the edge of the receiver is not low enough to catch it. Slower speeds will also result in longer life to the chain articulations. Bucket-and-belt elevators may be operated at higher speeds than many manufacturers' catalogs would indicate.

Until recently an idea prevailed in many quarters that 300 ft. per min. was the high limit to belt speed for this apparatus, and apparently it was thought this speed was constant, regardless of head-pulley diameter. While 300 ft. per min. may be a suitable speed for an elevator handling free-running granular material and discharging over a head pulley of small diameter, it may, on the other hand, be totally inadequate for an elevator running over a head pulley of larger diameter, or when handling material that has a tendency to pack in the buckets. Even if no trouble is experienced from failure of the buckets to discharge properly, the millman who adopts 300 ft. per min. as a hard and fast rule will not get the most economical service from his belts.

The trajectory of a particle thrown from an L-shaped vane when passing around the head pulley of an elevator can be calculated and plotted, but the curves thus obtained are of comparatively little value except to show that belt speed must increase with head-pulley diameter in order to secure a good discharge from the buckets. When such a vane is provided with a front, however, the emergence of particles is interfered with to such an extent that their path cannot be plotted. Belt speed and shape of bucket then become matters of direct experiment in order to find the most efficient belt speed and the shape of bucket most suitable for any particular set of conditions.

Discharge of Nonhomogeneous Masses

But although the path of particles projected from an elevator bucket cannot be accurately plotted, the path followed by water and fine pulp can be plotted closely. The behavior of such material discharging from a bucket of standard shape at the head of an elevator has been treated in an illuminating manner by Arthur O. Gates.[1] The results obtained when the critical speed

[1] "The Wet-Bucket Elevator," "Eng. and Min. Journal," Oct. 18, 1913.

of the bucket tip is exceeded are treated in detail and a close study of the article will assist the young designer. Mr. Gates demonstrates that as the elevator bucket is drawn over the head pulley the surface of the water contained therein will continuously move to a position at right angles to the resultant of the forces of gravity and centrifugal momentum. It is stated that the critical speed is that at which these forces just balance each other at the top of the head pulley and it is assumed that an elevator the bucket tips of which are moving at this speed will discharge with maximum efficiency.

In practice, such a discharge takes place only from an elevator carrying exceedingly fluid pulp. The material handled by elevators is not as a rule, however, homogeneous. As a matter of fact it consists of matter ranging in size from gravel to fine slime. If an elevator handling such material is watched closely as the buckets pass around the head pulley, it will be noted that the water is cast upward and outward from the lip of the bucket soon after it reaches the head pulley (if the belt speed is right) followed, as the top of the pulley is reached, by a discharge of sandy pulp. Then the coarse substances are projected over the back of the bucket in front and into the receiver. It is abundantly evident that although nonhomogeneous material is acted upon by the same forces the less mobile coarse material has not advanced so quickly to the point of discharge as the fluid pulp, and, because of retarding influences, its discharge has been delayed. This is just what should have been expected from a study of the forces acting upon the material within the bucket during its passage from the boot to the head of the elevator.

Effect of Higher Belt Speeds on Wet Sands

Sand and gravel, due to vibrations of the bucket line, settle quickly, forming a more or less packed aggregate with comparatively clear water above. When the head pulley is reached the water quickly responds to the forces acting upon it, and, obeying the resultant of these forces, begins to discharge upward over the lip of the bucket, if the latter is full and the bucket line vertical. A movement of fluid also will take place within the interstices of the material within the bucket and the finer sand will begin to discharge with the water. It is reasonable to conclude, however, that this movement will be retarded by friction within the settled mass. Presumably as the fluid contents are impelled to move away from the back of the bucket, air will enter the porous space thus vacated and weaken the coherence of the settled mass to the back and bottom of the bucket, and as all this takes place at a time when the discharge side of the bucket is being lubricated, as it were, by the fluid pulp forced against it, the net result is that a sliding movement is initiated along the outward sloping front of the bucket and the mass is projected into the receiver if the critical speed has been exceeded to just the correct degree. It is safer, however, to err on the side of a slight excess in speed and allow the back of the receiver to stop the material thus projected from the bucket than to miss the edge of the receiver and thus permit it to fall back into the boot. The efficiency of an elevator depends upon the amount of material picked up at the boot and landed into the receiver, so it is economy in the end to use a little more power and save the belt.

A vertical elevator will transport more material from the boot to the point of contact with the head pulley than can be raised with an inclined elevator; but, other things being equal, the contents of the buckets of the latter will be carried higher on the head pulley before discharge begins, and will therefore be discharged with a flatter trajectory than from a vertical elevator. Consequently the spill is likely to be less when the bucket line is properly inclined, and the amount of material projected into the receiver will in general be found to be greater than would be the case from a vertical apparatus. An inclination of 1:10 gives good results. The belt tension is also less when the bucket line is inclined, and the belt wraps the bottom pulley to a greater extent, resulting in less wear from slip. Other things being equal, speed must be increased when the diameter of the head pulley is increased, as the distance a particle must travel to reach the receiver increases with head-pulley diameter and the impelling force must be greater.

Low Speed Best for Dry Material

Dry-crushed material will be projected from the buckets in a more compact mass than will be the case with wet-crushed material. When dry crushing, however, it is generally desirable to minimize the production of dust, and the belt speed of elevators should be kept low, and the receiver placed lower than when wet-crushed pulp is being hoisted. It is safest, when maximum capacity is desirable, to err on the side of high belt speed and not worry over the warnings of the inexperienced as to the danger of material being carried around the head pulley. I have had elevators running up to belt speeds of 650 ft. per min. for short runs, and the discharge was good. Low belt speed has its evils; the buckets may be so overloaded that a steady spill will occur for some distance above the boot, and much of this material, falling between the belt and foot pulley, will remain there, to be ground between them when the foot pulley is again reached, with disastrous results to the belt. Also, material spilt may bank up in the boot and rapidly wear away the bucket tips as well as consume much power from friction, as illustrated by Fig. 8. An occasional slide of this banked-up material may completely choke the elevator. Be sure that material is not allowed to bank-up at this point.

Slow speed, therefore, although tending to prolong the life of chain elevators by minimizing strains in the chain articulations, may have an entirely opposite effect upon bucket-and-belt elevators and lead to their rapid destruction. Excessive belt speed, however, will also prove detrimental. The correct speed of an elevator can be determined only after all the conditions have been carefully appraised. In the best modern mill practice elevator belt speeds vary from 350 ft. to 500 ft. per min. Good practice indicates that for an elevator running over a lagged head pulley of 36-in. diameter handling material crushed to ¾ in. and less with a ratio of ore to water of 1:3, a speed of 400 ft. per min. is about right. It will be advisable to decrease this as the size of material increases.

Discharging Buckets with Packed Material

Should an elevator fail to discharge, several expedients may be tried. A canvas lining has been found useful in overcoming the tendency of clayey loads to stick in the buckets. If the material forms a more or less packed aggregate, small perforations in the bottom of

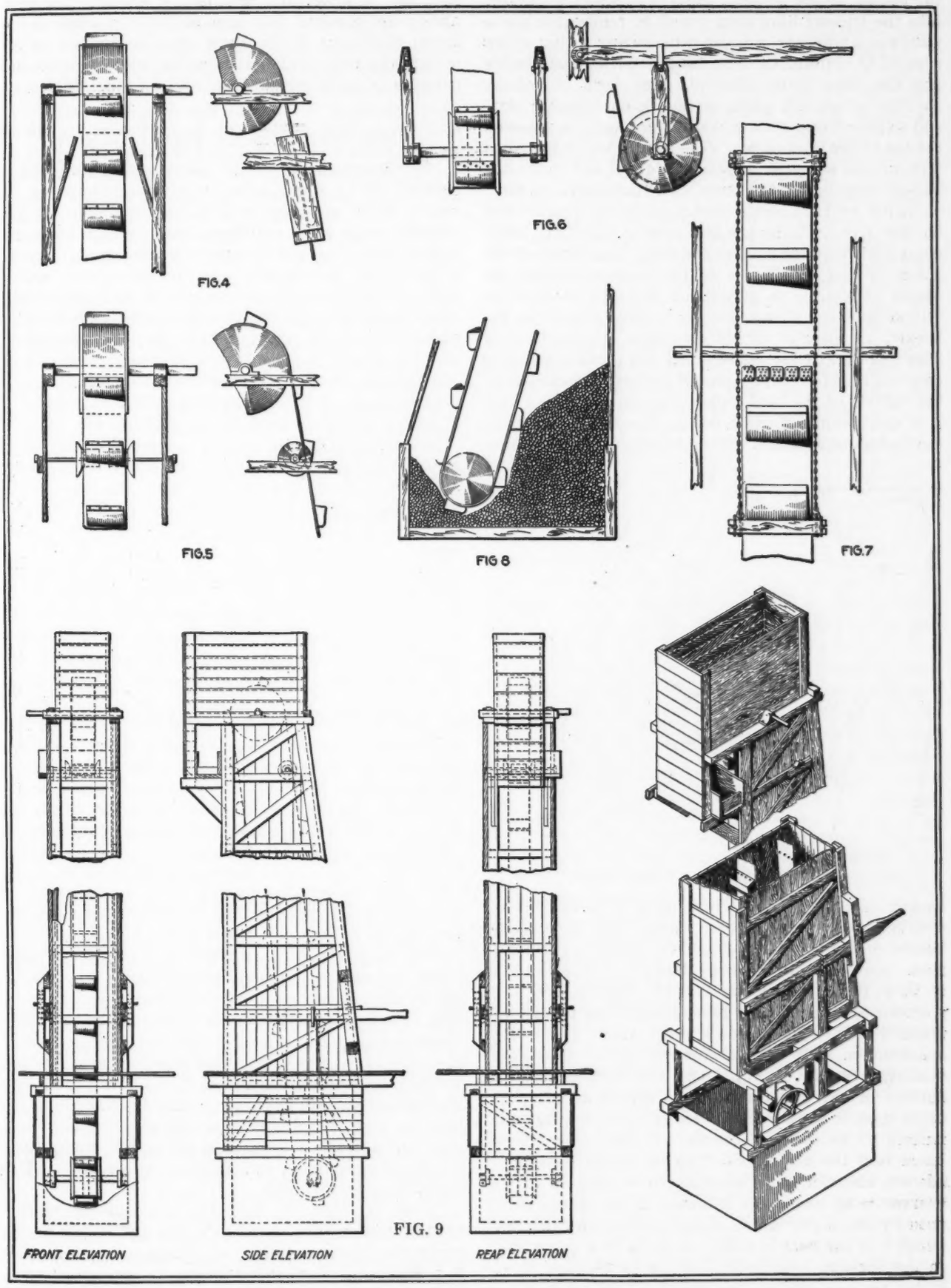


FIG. 9

CONSTRUCTION DETAILS FOR BUCKET-AND-BELT ELEVATORS

the buckets will loosen the adherence of the mass to the bottom of the buckets. Sprays of water impinging into the buckets have been found to relieve the situation, and a whacker or bumper delivering a blow to the edge of the bucket as it passes around the head pulley has also been found effective. One form of bumper consists of an oak plank swinging on a small shaft and so placed that each bucket will strike it on reaching the top of the head pulley. The impact tosses the plank upward and leaves it in position to fall and strike the bucket immediately following. The pendulum arc must be found by trial and a stop provided to prevent the bumper from striking the belt in case no bucket interposes itself between bumper and belt. The theory of the device is that the impact of the bumper distorts the bucket sufficiently to permit air to enter beneath the settled mass and thus accelerate its projection from the bucket. A piece of an old saw blade may be fixed as shown in Fig. 10. It will be noted that the steel whacker does not interfere with material projected upward from the buckets as the head pulley is reached.

A short length of chain bolted at each end loosely in the bottom of a bucket will also assist the discharge of

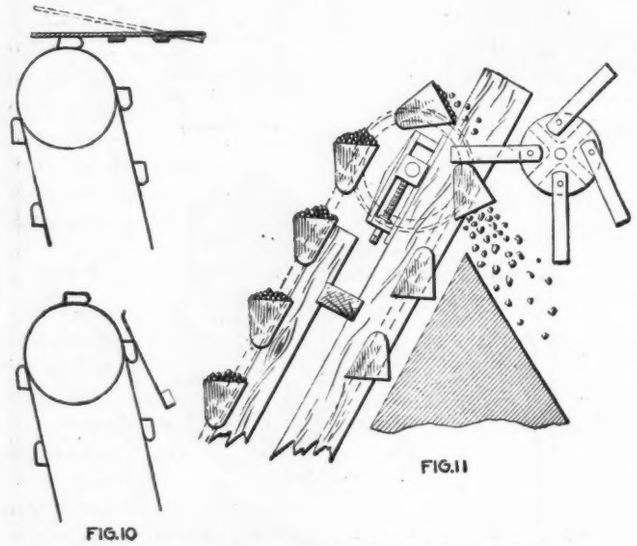


FIG.10 FIG.11

TAPPING DEVICES FOR DISCHARGING BUCKETS

packed material. At the Trojan mill, in North Dakota, a strip of iron working loosely on two bolts through the bottom of the buckets was used to effect the same purpose. A more positive device than any of these is that of D. T. Blakey,[*] shown in Fig. 11. This is driven by a sprocket chain from the head-sprocket shaft and when properly adjusted for the "knocker arms" to work in synchronism with the elevator buckets of a positive-discharge elevator it will compel the ejection from the buckets of any material that the apparatus should be called upon to handle. Such "kinks," of course, are only makeshifts to assist discharge. It should be remembered that the centrifugal type of bucket elevator is adapted only for material that can be induced to discharge freely under the influence of the forces developed by the flight of the bucket line around the head pulley. If the pulp is sticky or packs in a dense mass in the buckets, a centrifugal-discharge elevator is unsuited to the work and the use of a positive-discharge conveyor is probably indicated.

[*]Mechanical engineer, Knoxville, Tenn.

Handling the usual sizes of material treated upon jigs, etc., in a wet-treatment mill, a well-designed belt-and-bucket elevator will meet all but the most exceptional conditions if the same care be devoted to its design and construction that would be considered imperative in any other unit of a modern concentrator.

Some Aspects of Rand Mining

The annual address of the chairman of Consolidated Gold Fields of South Africa is always interesting by reason of its wide survey of the mining field, but his remarks about Rand conditions are of especial interest to Americans this year on account of the prospective participation of American capital in that field. Other gold-mining fields will also recognize in Lord Harris' speech much that appertains to the particular difficulties under which gold mining is now being conducted all over the world. He also brings up other points of special interest at this time, such as mine taxation and the importance to the British Empire of the continuance of gold production. Lord Harris said in part:

"Turning to general subjects, there is one toward which I think I ought to call your attention specially, although it affects interests far wider than those of the shareholders of the Consolidated Gold Fields. Douglas Christopherson, manager at Johannesburg, says in his report: 'South Africa would undoubtedly have been vitally affected detrimentally had the operations of the gold-mining industry been considerably curtailed.' I think he might have said not only the Union of South Africa, but the Empire also; at any rate, our experience is that those governments that are able to arrange for the exportation of gold are very anxious to get it.

Increased Costs on the Same-Priced Product

"You know also that—I have stated it on several occasions—we are getting the same price per ounce for the gold, but it is costing far more to produce. In another part of his report Mr. Christopherson points out that, as indirect taxation is practically in proportion to the tonnage milled, it is obviously a far heavier burden on the low-grade mines, where profitable working is dependent on milling large tonnages, and he illustrates his argument by referring to Knights Deep, where he claims that the above form of taxation in the first half of 1917 amounted, as he puts it, to 200% on the working profit, which was only 9d. (18c.) per ton milled. I take it he means that, assuming a profit, before deductions, of 27d. (54c.), deductions for war levy, miners' phthisis charges, railage on stores and gold and licenses amount to 1s. 6d. (36c.) per ton, leaving only 9d. (18c.) per ton working profit, and then before this working profit can be distributed there has to be deducted further expenditure on replacement and renewals of machinery and plant and amounts appropriated for capital expenditure, debenture redemption and interest which are not included in working costs.

"Now, my object in referring thus publicly to this matter is to call the attention of the authorities to the grave risk they are running of 'killing the goose.' If it is a matter of Imperial importance to produce as much gold as possible, some inducement must surely be offered to the shareholders in these mines, which are perilously near having to close down, as, owing to the cost of

working being so heavy, they show scarcely any profit. We have time and again pointed out to you that the return from a mine in the shape of dividends is not all true profit; it is partly a return of capital and partly interest on investment, because a mine is a wasting asset, and it would be quite unreasonable to expect shareholders to continue to extract ore from their mine if no return is coming to them, any more than it is reasonable to expect the merchants, traders, or the farmers of this country, whose freedom of operations is being interfered with by the government owing to the exigencies of the war, to carry on their business regardless of whether these businesses are profitable or not. There have been, of course, innumerable cases already where the government has had to acknowledge that a reasonable profit must be allowed. Even the excess-profits tax acknowledges that, in the first instance, a profit to the business concerned is a legitimate first charge.

Possible Extension of Low-Grade Mines

"I do not see how the government can possibly take the line that the production of gold is so important that it must go on whether it is profitable or not. If they did, then I suppose the shareholders might say that the government must take over the working costs themselves, but even then the property of the shareholders would be wasting and unremunerative unless they received some compensation for disturbance from the government. Mr. Christopherson stated that a quarter of the working mines on the Rand are now affected by this serious outlook, threatening the total extinction of the low-grade mines as taxpayers, as employers of labor and as consumers of South African mining supplies and produce. You will see from his report that he points to this fact—that, whereas 25 mines were working in July, 1914, at an average profit of 5s. 10d. ($1.42) per ton, these mines are now working at only 2s. 2d. (53c.) average profit per ton, showing a decrease in tonnage between the two years of 1,786,416 tons. This result is, of course, not all due to taxation or to increase in cost of labor and supplies; I do not suggest that. It is, in the case of the low-grade mines, also attributable to shortage of native labor.

Relief Necessary to Maintain Gold Output

"Now, these adverse conditions do not apply with equal weight all round. The companies of the Far East Rand have, of course, the advantage, apart altogether from the merits of their ore, of the experience of the older mines, and have been able to avoid expenses which were not avoidable in older days. At present eight Far East Rand companies are working at a profit of 18s. 3d. ($4.44) per ton, while the remaining 42 companies on the Rand are working at only 5s. 3d. ($1.28) per ton profit. Surely in these days, when a graduation of income taxation is recognized as legitimate, it might with justice be applied to the South African profit taxation; but, whatever the method, I do submit that it is necessary for the government to look carefully into this matter and find some way of remedying the unduly heavy burden which is now laid on the poor-grade mines, with a view to providing some relief, and that as promptly as possible, unless they are prepared to do without the gold which, we are given to understand, is so essential for the necessities of the Empire, and also unless the Union of South Africa is prepared to face a considerable falling off in receipts from the taxation of mines.

"The general effect of the adverse conditions under which the gold-mining industry in South Africa is being carried on is best illustrated by the fact that for the year ended July 31, 1917, the amount distributed in dividends by the gold mines of the Rand was £6,732,000 odd as compared with £7,985,000 odd for the corresponding period immediately prior to the outbreak of war, being a decrease of no less than £1,253,000 odd, and this would, of course, have been considerably greater had it not been for the increased dividends paid during the latter period by the Far East Rand companies.

"I submit that this is a condition of affairs which is not justified, having regard to the sacrifice made by you and the efforts that have been made by your officers not only to work your mines economically, but to introduce greatly improved conditions for the employees. The working costs of this group come out at 16s. 2d. ($3.93) per ton milled, as against 18s. 6½d. ($4.51) for the whole of the Witwatersrand.

Improved Working Conditions

"A considerable advance has apparently been made in the use of small machine drills, which are at last showing considerable efficiency; a rigid economy is being exercised in the way of stores, and, owing to the efforts of your representative, amicable results have been obtained by meetings of employers and employees, and Mr. Christopherson considers that there is now a better feeling between the two than has existed in the past. Success is resulting from the continued efforts to eliminate dust in mine workings, and it is becoming apparent that there is now little danger of contracting miners' phthisis. Mr. Leslie claims that the general health and fitness of many of the employees has benefited considerably by the arrangements made for physical culture—which have been supported by Mr. Christopherson—on our mines. Mechanics' working time has been reduced to 48 hours per week, and their holiday leave has been extended. Holiday leave on a more extended scale has been granted to underground employees, who have been offered a 48-hour week, and the war bonus to mine employees has been extended with the increased cost of living. The mining industry is sharing in the expense of a largely extended scheme for giving youths a practical training in mining.

"These various measures constitute collectively a heavy expenditure on the part of the mining industry, and I submit that, having regard to these improvements which have been made by your representatives, and for which you pay, it is only reasonable to advance a respectful petition that the extremely adverse conditions under which the low-grade mines are working shall receive sympathetic consideration from the government. But whether we do receive it or do not, I hope you will not forget that these adverse conditions are temporary. They may entail considerable hardships to shareholders for a short period in the way of loss of income and excess of depreciation, with a resultant drop in dividend; but after the war there will be a return to South Africa of a large number of of natives, and, of course, also many of our skilled employees and officials, and, though the prices of commodities naturally will not drop at once to the old level, still they are likely to seek a lower level

than at present. Naturally, we shall do our best to minimize the hardship, and I am hopeful that several factors may add to our profits in the current year and help to counterbalance the adverse circumstances.

"Then we have some more cheering news as regards prospects. The Simmer Deep will have the benefit soon of improved winding equipment in both shafts, which will render the lower levels more accessible for working and the development at the lower levels is so encouraging, especially in view of that in the Clement shaft section, that it has a really good chance of making a much better showing. Were it not for war conditions, the mine would today be making about £7000 profit a month, while the charge for redemption of first and second debentures and the interest on the first and second debentures amounts this year to about £73,000, and is annually decreasing. When, therefore, we reach, as we may hope we shall do when we get the labor back, that level of revenue, the surplus of profit over these recurring charges will annually increase.

At Robinson Deep, the new vertical shaft made excellent progress, and the result of the development work in the Booysens claims is distinctly encouraging. As regards Sub Nigel, you can see for yourselves that the market has viewed favorably the proposal for the increase of capital for the purpose of sinking a new shaft and development for a greater tonnage, and, in connection with the proposed sale of some of our Grootfontein claims to that company, you will have noticed with satisfaction, I am sure, that Mr. Leslie believes, from data showing in the Springs Mines and the Daggafontein mines, together with the development in Sub Nigel, that the Farm Grootfontein is traversed from end to end by the richest course of the gold-bearing reef of the Far East Rand.

"I am able also to turn to Rhodesian affairs with considerably more confidence than previously. The rearrangement of capital has placed the Gold Fields Rhodesian Co. in the dividend-paying list, and the prospects of several of its largest interests are of a distinctly encouraging nature."

Tin Shipments from Hongkong

Shipments of South China tin to the United States during July, August and September were fairly in proportion to the high record set for the first half of the year, according to a report from Consul General George E. Anderson, at Hongkong, British China, dated Sept. 27. In July there was a prospect of a shortage of tin supplies in South China and other producing centers in the East, but since then production has increased somewhat, and, in spite of shipments to the United States during the quarter valued at almost $1,000,000, the market in Hongkong was somewhat easier. Recent sales have probably been made of stocks heretofore held for speculation and now sold to prevent further losses. Exports to the United States for the nine months ended September 30 were valued at $3,264,652, as compared with $1,235,632 in the first nine months of 1916 and with $901,823 in the first nine months of 1915.

Exports of tin to other portions of the world during the year to date have increased a little over 40%, while the total shipments to all countries have increased about 58%. The figures, according to the returns of the Hongkong General Chamber of Commerce, for the first nine months of 1917 are as follows, the quantity being given in slabs of 112 lb. each and the corresponding figures for 1916 being given in parentheses: To Great Britain, 16,920 (22,373); to the continent of Europe, 21,800 (4800); to the United States and Canada, 22,874 (10,829). High exchange had a marked influence against export of the metal, but the nine-month period closed with easier exchange and an easier tin market.

Platinum in Ronda Mountains, Spain*

Prospecting for platinum by the engineers of the Spanish government still continues among the placer deposits in the Serrania de Ronda. The region that is being investigated lies near the coast, halfway between Malaga and Gibraltar, a little to the west of Marbella, and includes several rivers with substantial gravel deposits, among them the Verde and Guadaiza. Considerable preliminary work was done in 1914 and 1915. In February, 1916, the investigating commission under the direction of the Geological Institute was directed to continue its work and to study the deposits of chrome, magnetite, and nickel, which are desired for military purposes. Since then the work has progressed slowly.

In the investigation of the platiniferous placers, holes have been dug at intervals of 200 m., and between these soundings have been made every 20 m. The deposits along the River Verde have all been tested, and along the Guadaiza the examination is nearly completed. On both of these rivers a quantity of platinum is said to have been found which, though not extraordinary, may be regarded as favorable enough from an industrial point of view, considering the present prices of this metal. While the investigation on the Guadaiza is not yet ended, it is believed that the quantity of platinum there is greater than on the Verde and that the average depth is somewhat smaller—not in excess of 33 ft. on the Guadaiza and 49 ft. on the Verde.

On the Verde 68 holes have been dug, making a total depth of 776 m., from which 24,079 liters of material were taken and washed to determine the platinum contents. On the Guadaiza 109 holes have been dug, making a total depth of 872 m., from which 21,800 liters of sand were taken and washed. This work has been carried on with two imported second-hand drills. Operations were discontinued for the summer because of the lack of water and the difficulty of boring. The prevailing heat and miasma also make it advisable to suspend work from July until September.

In prospecting for other minerals the region has been divided into areas of 2 to 5 sq.km., which are being investigated progressively by groups of 8 to 10 men, looking over the ground meter by meter and sending samples to the central office for analysis. It has been established thus far that there are 10 deposits of rich chrome which may be exploited, and from 16 to 18 of magnetite and chrome iron. Deposits of nickel, which is the most important of the metals for military purposes, have been found in quantities which are expected to meet the needs of the Spanish industry for several decades at the rate it is now being consumed; the predominating mineral is garnierite.

*Excerpt from a report from Consul Louis G. Dreyfus, Jr., at Malaga, Spain, in U. S. Commerce Report, Oct. 23, 1917.

Marketing of Lead by the Smelter

The problem of the marketing of the miner's lead by the smelter is ably set forth by Edward Brush who has long been in charge of the selling of lead and silver for the American Smelting and Refining Company.

MANY facts of interest to the lead miner, the smelter and the purchaser of lead were contained in the affidavit of Edward Brush, vice-president of the American Smelting and Refining Co., in connection with the suit brought by that company against the Bunker Hill & Sullivan Mining and Concentrating Co. in the U. S. district court of Oregon. Limitations of space obviously prevent a detailed presentation of the legal and controversial aspects of the case, but the following excerpts from Mr. Brush's affidavit set forth clearly some of the selling handicaps that have burdened both the producer and the smelter of lead:

The smelting business prior to 1900 had been one of great uncertainty, because the custom of the trade had been to establish numbers of small smelteries, the lives of which were often short, depending upon a given mine, or at least a given mining district. Their metallurgical work was poor and their metal losses consequently great.

The custom of the trade is and always has been for the smelter to buy the mine product, consisting of ores, concentrates and slimes, paying for the metal contents of this product at the time of delivery. The amount paid the producer in the early days was generally a flat price, much less than the market figure, because of the fact that at least three to four months must elapse from receipt by the smelter until the final refined metal, in commercial form, can be sold and delivered in the market. Meanwhile the prices of the metals might change materially. Obviously the smelters would pay only at a rate which would insure them against loss.

New York Prices Rule Lead and Silver Market

In the metal business the great market for the United States for both lead and silver is New York, and hence all contracts are based upon New York prices, excepting for the soft-lead fields of Missouri and Oklahoma, which are based on a secondary market in St. Louis. However, as the difference between the St. Louis price and the New York price amounts merely to the freight between the two points, this does not make a substantial difference.

To sell its metals without loss is a very important problem in the smelting business. As stated, it takes at least three months from the receipt of the ores before the smelter can finally deliver the lead content thereof in the market. During this time the price of lead and silver may rise or fall, or do both. At first blush, it would seem that the profit made on the rising price would offset the loss made on the falling price; but this does not prove to be the case in actual experience, even though the price may be averaged and on the whole the amount of rise and fall is equal. The effect is not balanced for the reason that when prices are rising the consuming manufacturing trade, realizing the probability of an increase, buys as rapidly as possible to supply its necessities for a considerable time in the future. Also, the mines over-produce at high prices and lower their production when prices are depressed.

The lead and silver business, like nearly all other businesses, such as steel, lumber, etc., is subject to periods of depression, during which time the smelter is obliged to buy the mine product but can sell nothing. As a rule, lead is high when the country as a whole is enjoying great prosperity and there is a consequent building development which necessitates the use of lead for paint and for plumbing purposes, and of late years, when electrical equipment is expanding, for lead-covered wire and for batteries. When the period of falling prices sets in, the consuming trade buys from hand to mouth, because it feels that the price will go down and hence carries no surplus stock.

Variation in Silver Price a Troublesome Factor

Silver has also been a disturbing factor in the business and is subject to wide variations which are based not only upon the consumption of silver in the arts but upon its use as money. The price of the metal is largely governed by London. The transportation of the metal in India and China, which still use it as a basis for their money supply, takes considerable time, and hence the risks of handling silver are particularly great and call for great care and attention. It is important that one be in a position to get widespread information and to be able to act quickly upon that information, if he desires to avoid great losses in handling the silver-bearing product.

The result is that the smelter to some extent "holds the sack," to use a colloquial expression. He has to make his contracts more or less based on the requirements of his customers to the extent of his ability to fill them; hence, if the customer wishes a large quantity and the smelter has it, he must supply the amount desired. If, however, the customer wants only a small quantity, the smelting company is left to carry large quantities of lead or silver, with consequent great risk, should the price fall.

Metal Equivalent of Ores Purchased Sold Daily

As a consequence of this condition in the old days, before the organization of the American Smelting and Refining Co., the smelters were accustomed to sell, if possible, each day the amount of lead which they received at the price prevailing on that date, agreeing to deliver it three or four months thereafter. This led to the development of a large group of middlemen in New York who would purchase from the smelter and would thus take the risk of carrying the lead until the consumer wanted it. The result was that they acquired what is called "spot lead," that is, lead which could be delivered immediately, and they would obtain control of large quantities of this at periods of low prices and carry it over until they could dispose of it when prices were high. As a result, the mine got on the average an unsatisfactory price for its lead output.

It became obvious that it would be wise for all concerned, mine, smelter and consuming public, if the inequalities of this system could be somewhat mitigated,

and both miner and smelter be able to protect themselves. To do this there was inaugurated a form of contract with the miner under which a percentage of the price allowed was given to the smelting company, so that it would be directly interested in the amount obtained for the lead in the market, and thus be compensated for carrying charges and the risks it would have to undertake if it abolished the old plan of selling the lead on the day of receipt for whatever it could get, the lead to be delivered four months afterward. This general policy of the trade was embodied in contracts in which it was agreed to pay for 90% of the lead at 90% of the New York price up to $4.10 per 100 lb., and above $4.10 per 100 lb. dividing the price of the lead between the miner and smelter.

The result in practical experience was that the miner averaged a greater price for his lead than under the old system, while the smelting company, being also interested, had an object in at times carrying the lead over dull periods to sell it in periods of better prices. In fact, it absorbed the functions and the field theretofore occupied by the middlemen above described. But to do this the smelting company had to make contracts with the important consumers. Obviously it could not make such contracts unless it was reasonably sure of being able to deliver the lead.

The present high price of lead is the result of these conditions: (1) Production in Mexico has practically ceased during the years of anarchy which have recently prevailed in that country; (2) the shortage of ships, due to their destruction in the U-boat warfare, and their use in carrying of war munitions, has practically shut off the supply from Australia, one of the largest fields of production in the world, and the same conditions have affected the supply from Spain; (3) the increased use of lead for war purposes.

Owing to the advantages of long-time contracts, or of some connection between miner and smelter, all the important lead-producing mines of the country now have their output arranged for for many years in advance. Every smelter in the business from the years 1890 to 1893 will recall that many smelters in the country were absolutely ruined and that the financial status of all was seriously impaired by the continued fall in the price of silver, which culminated in the famous panic of 1893. The smelters simply could not sell the silver for what they paid for it, until finally in despair they refused to pay for the silver except upon the price prevailing in the market at the time the silver finally reached the market.

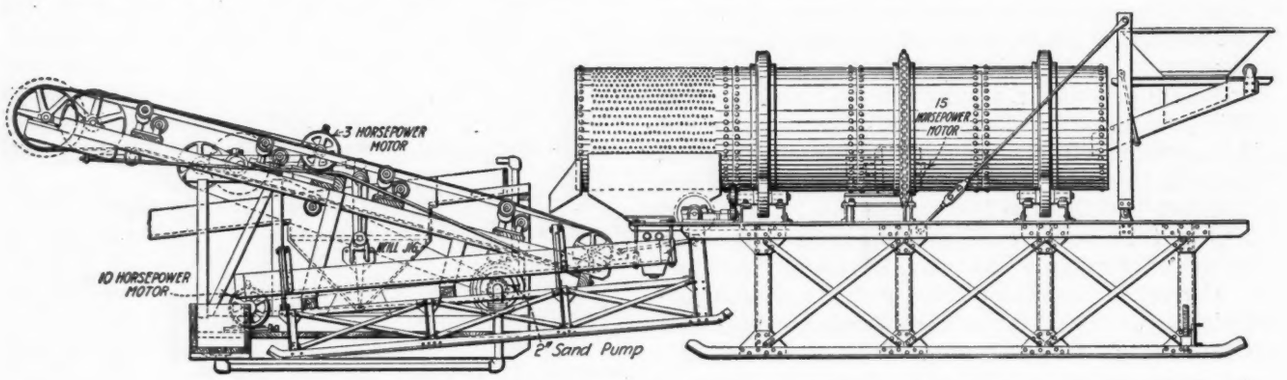
Now, miners as a rule want to sell their products, which are ores, concentrates and slimes, for cash. The risk and expense of selling then fall upon the smelting company and it accordingly equips itself extensively to sustain that burden. It has established lines of information as to the influences affecting the price of lead and silver throughout the world, and has built up a large organization of agents in all important markets.

Recovery of Comstock Tailings from Carson River

By Lewis H. Eddy*

Considerable gold and silver are believed to have been deposited in the Carson River in the form of chlorides, quicksilver and amalgam from the tailings of the mills that treated the ores of the Comstock mines prior to 1899. The Unevida Gold Mining Co. will attempt to recover the quicksilver and amalgam and whatever other valuable metals there may be in the river, by the installation of a plant for conveying and washing the gravel and cleaning bedrock. Three problems, low cost of handling the gravel, cleaning the bedrock, and scouring the recovered quicksilver confront the company.

The Unevida plant will be built at a point near the river shown in the photograph. The cost of recovery can be determined positively only by actual operation, but it may be estimated on the basis of excavating, conveying and washing gold-bearing gravel by the plan of operation that is to be adopted, which is a combination of simple methods already in use in gold-placer mining, composed of (1) endless-chain bucket conveyors, (2) revolving screens, (3) gravel washers, (4) Neill jigs. The bucket conveyor to be installed is designed from one used 20 years ago at the Alturas Mine, Sierra County, California. This conveyor, shown in an accompanying illustration,[1] was constructed by W. S. and A. M. Packer and was not patented. The gravel was shoveled by hand into the buckets on the lower side of the double chain and was carried up and around the driving sprocket on the platform and dumped into the hopper. The empty buckets returned in an inverted position until they rounded the sprocket wheels at the other end and again come into position to be filled. The original conveyor was driven by a 3-ft. water wheel, provided with a 3-in. nozzle under a 40-ft. head.

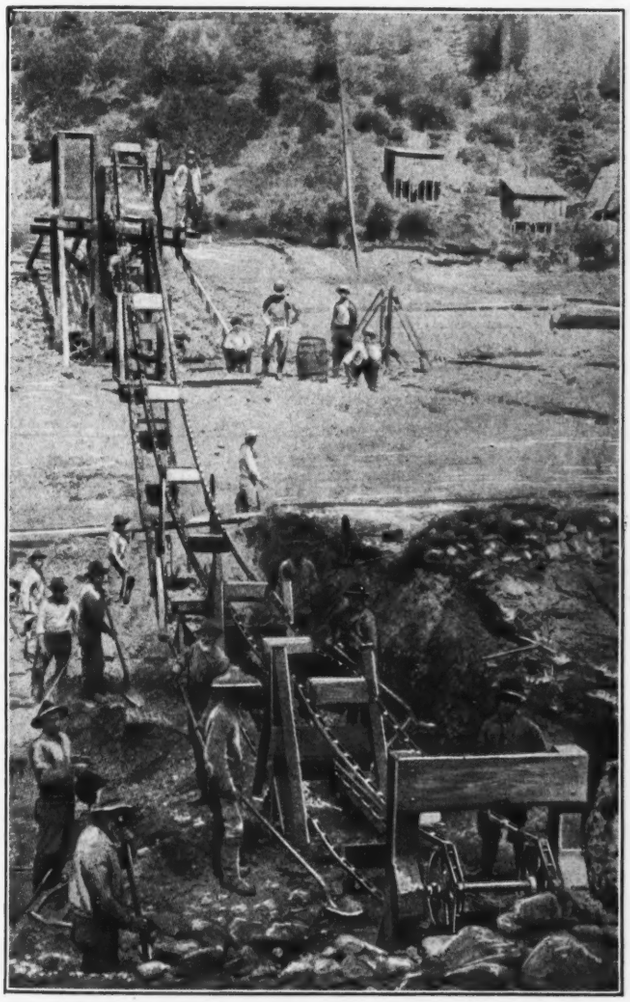


GRAVEL WASHER DESIGNED TO TREAT THE CARSON RIVER GRAVEL

*Associate editor, "Engineering and Mining Journal," San Francisco, Calif.

[1]"Thirteenth Report of State Mineralogist," 1896, Sacramento, Calif.

SITE OF UNEVIDA OPERATIONS ON CARSON RIVER



THE PACKER GRAVEL CONVEYOR, ALTURAS, CALIF.

The Carson River plant will be composed of a conveyor of this type; a trommel or a revolving screen as shown in the drawing, 16 ft. long and 4 ft. in diameter; sluices; tailings elevator and Neill jig. Material from the stream bed will pass from the conveyor buckets into the hopper, then to the revolving screen. The coarse will pass out into a conveyor, and the fines, passing through the $\frac{5}{16}$-in. perforations of the screen, will go into the ordinary type of mill amalgam trap. The overflow will pass into a sluice 12-in. wide and about 12 ft. long, which is hung on standards and worked by an eccentric, having an end-shake stroke of $\frac{3}{4}$ in. 400 strokes per minute. This sluice and the revolving screen were originally intended for use at Battle Mountain, Nev.; the idea being to put through the largest amount of gravel possible with the smallest amount of water. The gravel will travel dry through the sluice, the water being used only to wash the fines out of the riffles. In other words, the water does not drive the gravel through, as in ordinary sluice work. From the shaking sluice the pulp will be pumped through a centrifugal pump, which will lift it about 5 ft., the discharge to pass through a Neill jig.

The Carson River is to be turned from its bed by a combination of ditches and centrifugal pumps, the pumps taking care of the seepage. A section of the river will be surveyed, its course diverted and the gravel worked out, and then the plant will be moved forward to another section. The entire washing plant as well as the conveyor plant will be built so as to be readily moved from one point to another.

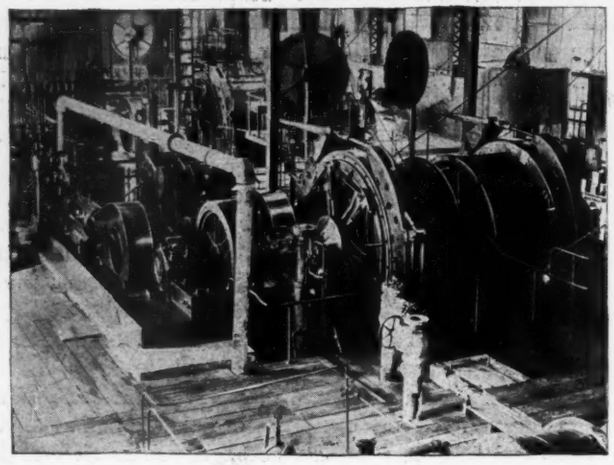
Acquisition of Mines by Aliens Forbidden in Great Britain

The acquisition of mines in Great Britain by aliens without license was prohibited under an order of May 2. This prohibition has been drastically extended under an order of Oct. 28, which forbids the transfer of mine holdings to aliens wherever the mines are situated. The text of the regulation now reads as follows:

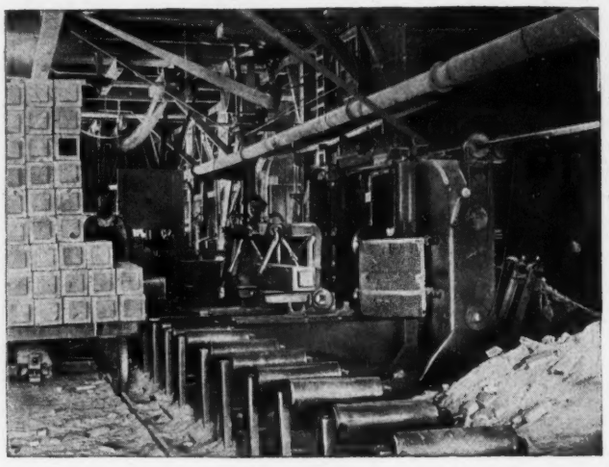
A person shall not, without the consent of the Board of Trade, transfer or agree to transfer to or for the benefit of an alien or a foreign-controlled company any interest in any mine to which this regulation applies or any interest in an oil field, or any share, stock, debenture or other security issued by any company owning such a mine, or any interest in an oil field, or by a company having directly or indirectly by means of the holding of shares in any other company or otherwise the control of such a mine or oil field, or accept or agree to accept such a transfer. If a person acts in contravention of this regulation he shall be guilty of a summary offense against these regulations. For the purposes of this regulation the expression "foreign-controlled company" means any corporation (*a*) where the majority of the directors or persons occupying the position of directors, by whatever named called, are not British subjects; or (*b*) where the majority of the voting power is in the hands of persons who are not British subjects, or who exercise their voting powers directly or indirectly on benalf of persons who are not British subjects; or (*c*) where the control is by any other means whatever in the hands of persons who are not British subjects; or (*d*) where the executive is a foreign-controlled company, or where the majority of the executives are appointed by a foreign-controlled company. The mines to which this regulation applies are mines wherever situated from which any ores of the following metals are extracted, that is to say, copper, lead, tin, tungsten, zinc or any other metal which may hereafter be added by order of the Board of Trade.

These regulations are assumed to be only for war times. They are likely to prove awkward if enforced in other countries.

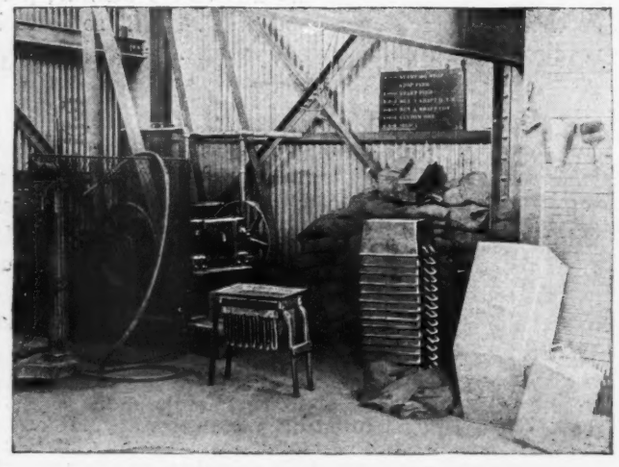
Photographs from the Field



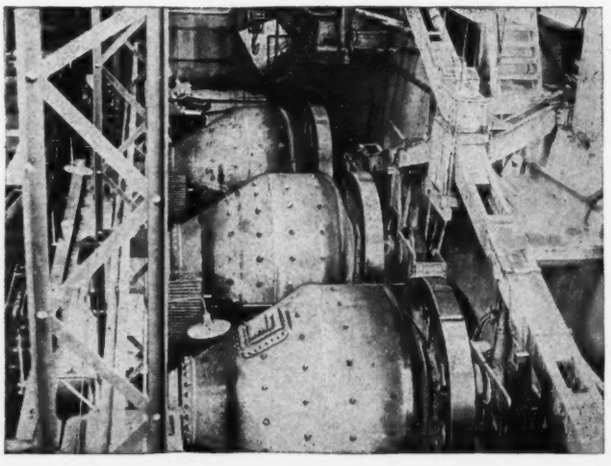
Hoisting engines at "A" shaft of Old Dominion Co.



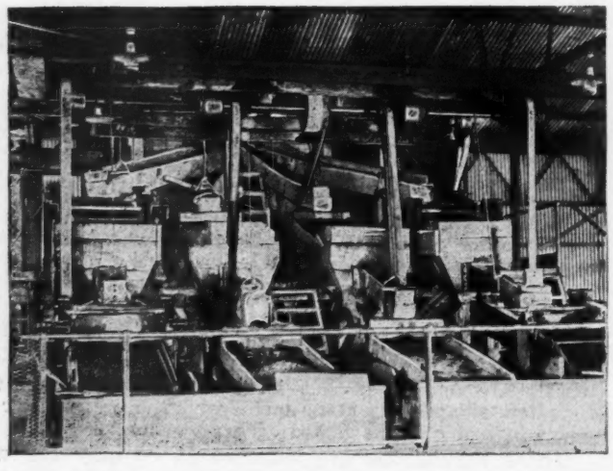
Framing machine for underground mine timber



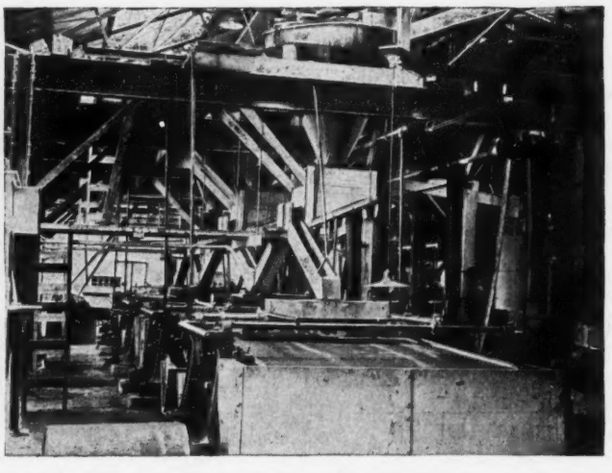
Regrinding room in sampling mill



Hardinge mill section of the concentrator



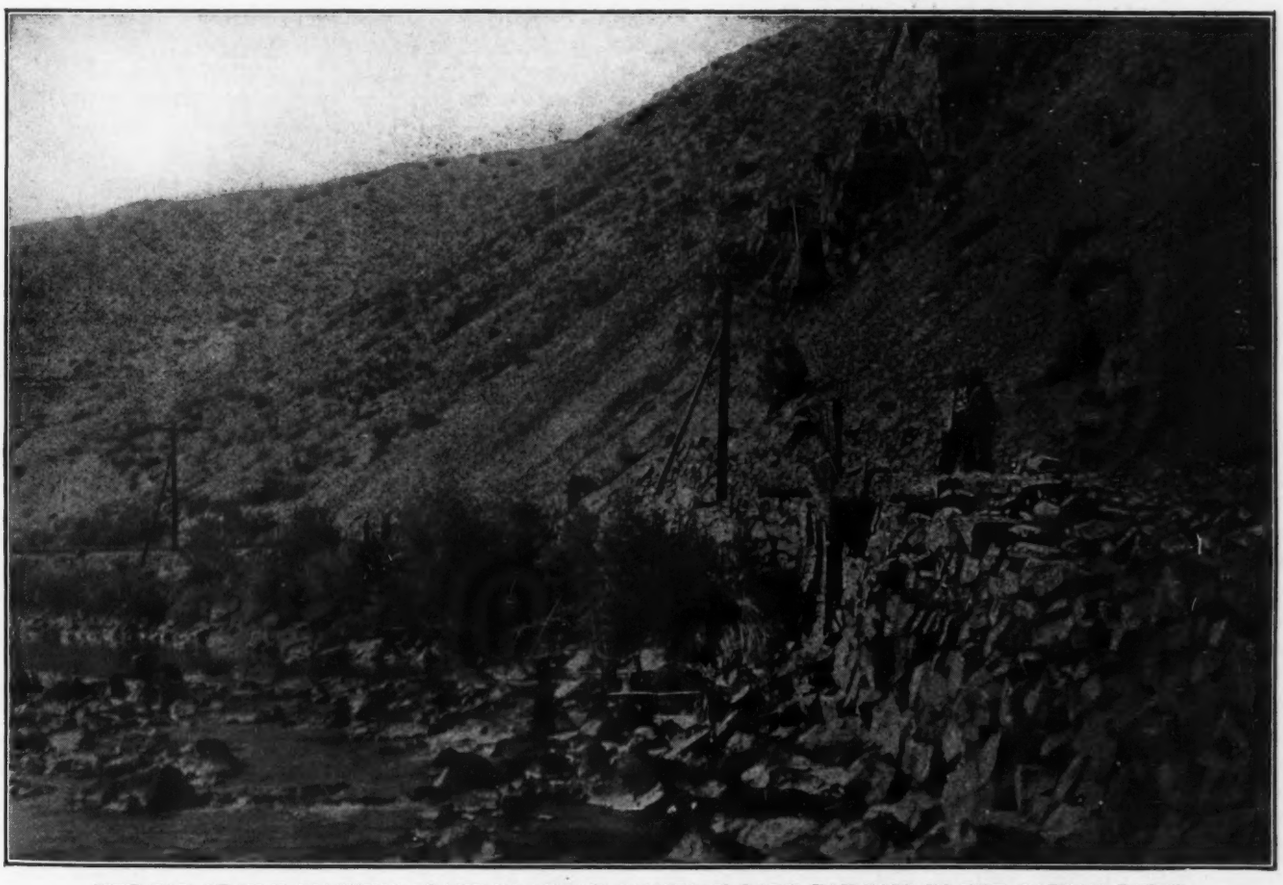
Shaking screens at concentrator



Senn vanners fed from Allen cones

SOME INTERIOR VIEWS AT THE PLANTS OF THE OLD DOMINION CO. AT GLOBE, ARIZ.

THE OLD BRUNSWICK MILL THAT FORMERLY TREATED COMSTOCK LODE ORES IN NEVADA



SITE FOR GRAVEL-WASHING PLANT TO TREAT COMSTOCK LODE TAILINGS IN THE CARSON RIVER

The Unevida Gold Mining Co. expects to work Comstock tailings for the recovery of amalgam and live quicksilver that escaped from mills into the river in the early bonanza days

Correspondence and Discussion

Is Gold Mining Necessary During the War?

I am surprised that J. Parke Channing should advocate the closing of the gold mines of the country.

In his article in the *Journal* of Dec. 8, he deprecates the necessity of our Government accumulating additional reserves of gold. In the same breath he admits the correctness of the policy of Great Britain of increasing its gold reserves by stimulating the production of this metal in her colonies. He doubts, however, whether Great Britain would encourage the production of gold in Great Britain itself. This assumption on his part is rather a ridiculous one, in view of the fact that there is no gold-mining industry in Great Britain.

The financial position of the United States after the war will be sound in proportion to the amount of the yellow metal it has on hand. We are already pyramiding a gigantic war debt on a gold basis none too broad.

The gold-mining industry in the United States is suffering under enough handicaps in the way of high costs of operation without having any additional burdens laid upon it. The policy of the Government should be to regulate the prices of explosives, steel, cyanide, carbide, etc., required by the gold mines by establishing a reasonable maximum, especially in view of the fact that the Government has already fixed the price of gold at $20.67 an ounce. While the owners of the base-metal mines have profited extravagantly, the gold miner has had no compensatory advantage.

The Allies have no lack of the base metals essential to the winning of this war. The great gold mines of the world are comparatively low grade and realize but a small profit per ton of ore treated. Mr. Channing knows full well what it means for any big mine to lose its operating organization, which has taken years of hard work to get together, to say nothing of the rapid deterioration of plants when idle. It would not only be a crime, but the height of foolishness for the Government to close down, for instance, the Homestake Mine, in the Black Hills, where the sole product is gold. This would absolutely destroy a community of 10,000 souls, entirely dependent upon the Homestake, and at the same time deprive the Government of from $7,000,000 to $8,000,000 of gold bullion annually, as well as work an unnecessary hardship upon an industry already taxed to the breaking point by high operating costs.

After the war our allies, England, France and Italy, to say nothing of our South American friends, will be in dire straits for gold. In the current year our Government has issued billions of dollars of bonds, for the redemption of which we will produce this year in round numbers only $175,000,000 of gold and silver. We are carrying the burdens for the Allies, and it is our solemn duty to leave nothing undone to provide as firm a foundation as possible upon which may rest the enormous mass of credits imposed by the war.

A fair consideration of this subject will demand that the production of gold be stimulated, rather than discouraged, and that the Government so regulate the cost of supplies that the industry may continue.

Trojan, S. D., Dec. 21, 1917. H. W. SEAMAN.

In the *Journal* of Dec. 8, 1917, Mr. Channing raises an interesting question, but it seems to me that he has not considered the subject from all angles. It is possibly true that this nation may be able, with care, to husband its existing gold supply so as to carry us through the period of the war, but how about the period of reconstruction which will follow the war?

The distrust between nations which the war has engendered and intensified will render it impossible to conduct international business on a credit basis; and governmental regulation will be ineffective to maintain artificial conditions of exchange. Most economists seem convinced that large quantities of gold will be required, and even the remonetization of silver may become essential to supplement the metallic basis of exchange.

Production of gold cannot be improvised, nor even rapidly stimulated, to meet sudden demands. It will be an unwise thing to interfere with production now, at the risk of a complete financial deadlock later, when an increased stock of gold is required.

If the principle of stifling non-essential industries be adopted, we can more wisely commence with such trades as are dependent on luxury, such as feminine fripperies, jewelry, and, to a less degree, automobiles, and the plants required to produce unnecessary commodities can be used for more essential manufactures. Above all, the labor temporarily displaced can be registered, and the factories reopened when peace conditions are restored. Mines once closed down are often impossible and always expensive to reopen.

Again, to throttle gold mining will involve wiping out entire communities, which it will be almost impossible to reëstablish after the war, while temporary suspension of industries producing articles of luxury affects, as a rule, only individuals. So far as discouragement of gold mining can be wisely permitted, it has already been done (and overdone) by natural conditions, such as high prices of mining supplies and machinery; and the fact that most of our best men have already left to work for Mr. Channing and his competitors.

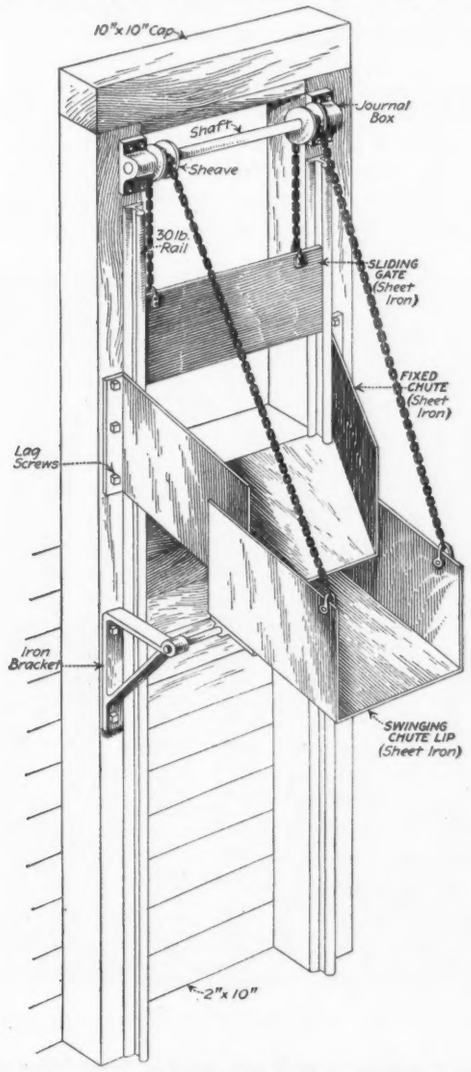
My own idea is that it would be a far wiser plan, in the long run, to assist gold mining (which is insusceptible to adjustment by natural increase of value of the product) by relieving it from all super-taxes. This, for obvious reasons, will not be of much direct benefit to the majority of gold mines; but it will assist the continuance of gold mining by helping to maintain the atmosphere of glamour on which its very existence—necessary as it is to the community under present conditions—so largely depends. GEORGE E. COLLINS.

Denver, Colo., Dec. 15, 1917.

Details of Practical Mining

Counterbalanced Gate and Chute Spout for Underground Ore Pockets

A type of chute gate used in loading 1½-ton cars from an underground pocket in one of the mines of the Southeast Missouri disseminated lead districts is illustrated in the drawing reproduced below. The gate is made of sheet steel, with side-edge fillers, and slides between the head and flange of two 30-lb. rails set vertically along the chute posts. Two light chains are fastened to the top of the gate by clevices, the chains passing over small



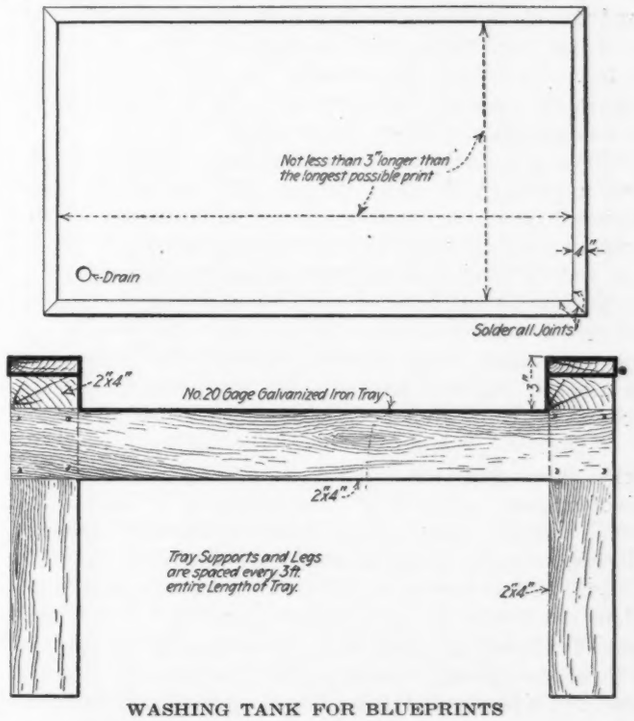
DETAIL OF COUNTERBALANCED CHUTE GATE AND SPOUT

sheave wheels mounted on a shaft which is held to the chute post above the gate in journal boxes. The chains at the other end are fastened to a swinging chute spout hinged to a bracket casting bolted to the chute post below the chute outside the rails. When the swinging spout is down the chute gate is raised, allowing the ore to pass through to the cars. To cut off the flow of ore the operator raises the swinging spout by means of a bar, and the gate is correspondingly lowered, closing the opening. The combination has the advantage of sharply cutting off the flow with but little overflow, which sometimes occurs when the ordinary gate not equipped with such a lip becomes jammed by large boulders. The illustration gives an adequate idea of the construction and arrangement.

Notes on Blueprinting

Although the increasing cost of blueprint materials has not resulted in the introduction of substitutes, there are several ways in which the waste to which most engineering departments are subject can be eliminated, and, while the following suggestions may embrace repetitions of methods before advanced, most of the "kinks" will be of service.

The blueprinting of an engineering department is often entrusted to a boy whose main idea of efficiency is



WASHING TANK FOR BLUEPRINTS

to get out a certain number of prints, regardless of other considerations, whereas experience has demonstrated that older persons, if properly instructed, will save enough in materials, time and annoyance to more than compensate for the difference in pay. The blueprint room or department should be separate from the main drafting room for a number of reasons, but chiefly because there should be no water or washing tank in the drafting room, since a small amount of water may ruin a $50 tracing. In addition to the regular equip-

ment in the blueprint room—blueprint frames, washing tank, drying apparatus, etc.—two tables should be provided of a size which would allow of 6-in. overlap on the largest print that the department may be called upon to make. One of the tables may be used for a paper-cutting table and can be marked off at intervals of 6 or 12 in., using brass-headed upholsterer's nails, and will be found convenient in measuring the paper before cutting it. Tracings should not be placed on the unexposed print paper and used as a guide for cutting the paper, as there is always the possibility of cutting them. Standard 10 or 12-in. shears will be found satisfactory for cutting and trimming. For convenience, the cutting table may be provided with a drawer for holding the paper before printing. The other table will be found handy for holding tracings so that they need not be folded or rolled. All tracings in the blueprint room that are not in the printing frame may be kept in drawers in the latter table, to prevent accident, but should be removed to the permanent file when the blueprinting operation is complete. Of the two types of blueprint exposure frames or machines, electric machines, when available, are to be preferred.

The sunlight frame can be used only when sunlight is available, and the printing operation is usually slower, although the cost is slight when compared with the electric machines. The electric machine, where power connections permit its installation, has the advantage of always being ready for use, regardless of the light or time; it prints faster than a sun frame and requires no guess work as to length of exposure, which makes it possible to produce any number of prints of the same shade, this feature being desirable when several prints are to be bound together in pamphlet form.

There are a number of washing tanks on the market, but a serviceable tank or tray may be cheaply constructed after the manner shown in the sketch. The water should be piped from a constant source, if possible, and the tank provided with an outlet so that running water may be available for washing the prints. A piece of rubber tubing about 1 in. diameter and 3 or 4 ft. long, attached to the faucet, provides water for the prints. If running water is not available, the water should be changed after washing two or three prints.

In brown printing or negative work the necessary fixing solutions can be put in large bottles and placed upon a small shelf. By means of a number of small rubber tubes, fitted with spring-wire tubing clamps, to regulate the flow of the solution, it may be siphoned off as needed, and it is not necessary to manipulate the bottles by hand while printing. A solution made by dissolving about 4 oz. of commercial potassium-bichromate crystals in one gallon of water can also be placed in a bottle on this shelf and applied to blueprints that have been over-exposed in the following manner: Wash the over-exposed print with clear water, then apply the bichromate solution; let stand until the lines on the print become white—usually about 30 sec.—and then thoroughly wash with fresh water. For drying prints, it will be found that bare copper wire, of No. 16 gage, will make excellent lines, since the copper will not form rust on the prints as do iron or steel wire. It is not necessary to use clamps or holders to hold the prints in place while drying, for if 2 in. of one edge of the print is folded over the wire and lightly pressed against the main part of the print while wet, the moisture will hold the edges together.

By grasping the lower edge of the print in one hand and lightly scraping the wet surface with a large draftsman's triangle, held at an angle of about 30 deg. to the print, it is possible to remove much of the water and facilitate the drying. Large desk blotters are convenient in drying small prints or prints wanted in a hurry. Where electric power is available, an electric fan will hasten the process. A standard trimmer, such as is used by photographers, is useful for trimming small prints, and will save both time and annoyance. Pencil lines, grease, dirt, etc., may be removed from the tracings before printing by rubbing the tracings lightly with a gasoline-soaked rag, taking care that none of the surplus ink is removed from the lines, for this will cause them to present a ragged appearance when printed. After a print has been dried and trimmed, it should be folded in such a manner that the title, date, etc., usually placed in the lower right-hand corner, should be on the outside or exposed portion.

Circular Rack for Blacksmith Tools

A blacksmith's rack that permits heavy tools to be kept in good order is described by Frank A. Stanley in *American Machinist*, from which the illustration is here reproduced. By the use of this device the tools may be found easily when needed and readily removed and replaced. The rack is circular in form, consisting of a steel ring about 6 ft. in diameter supported upon a series of arms branched out from the standard, which is mounted in a square flange at the base. The supporting hooks for the tools are U-shaped and double ended. When placed over the ring that forms the top of the rack, one end projects in and the other out, and thus tools may be hung up inside the ring as well as outside.

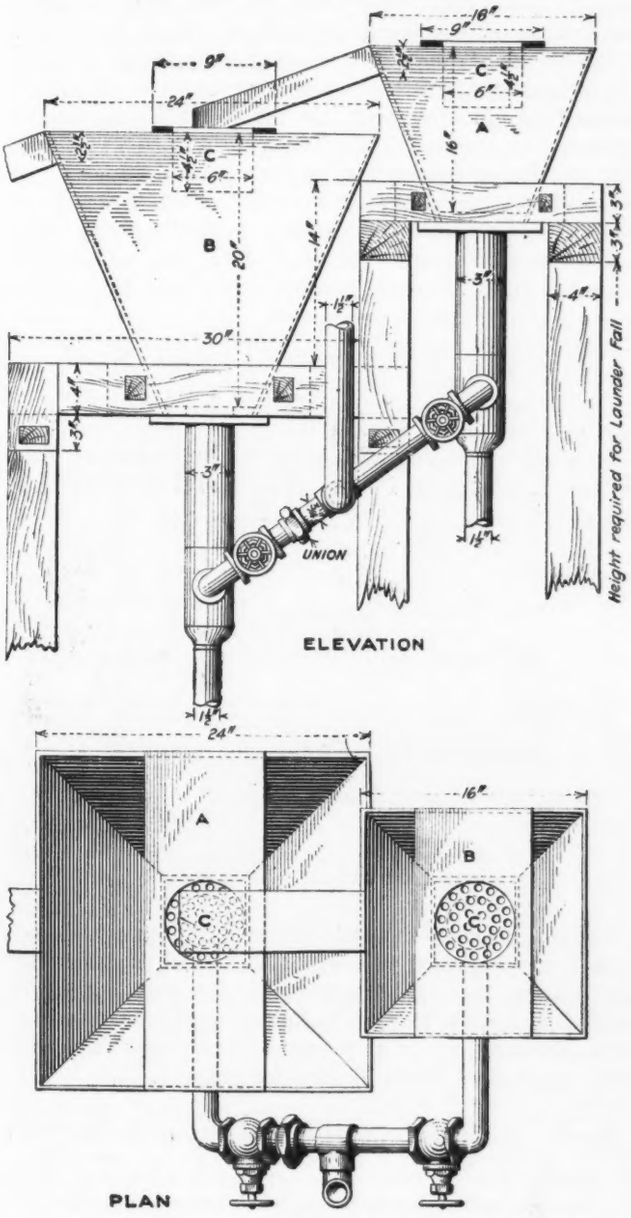
CIRCULAR TRACK FOR HEAVY BLACKSMITH TOOLS

Details of Milling and Smelting

Making an Inexpensive Classifier

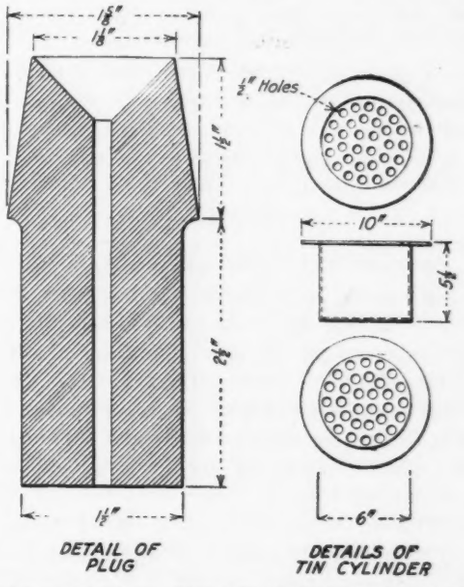
BY FREDERICK W. FCOTE* and RASTUS S. RANSOM, JR.†

In isolated localities or in small mills for working tailings dumps a small two- or three-unit classifier is often essential. The following is a description of a two-compartment classifier that can be made by any mill carpenter and gives excellent results.



DETAILS OF A SIMPLY CONSTRUCTED TWO-COMPARTMENT CLASSIFIER

The two compartments, A and B, are wooden boxes built in the form of truncated pyramids of dimensions as shown. One-half of a 3-in. pipe flange is bolted to the bottom of each box, all joints being made watertight. A 3 x 12-in. nipple is screwed into the flange and a 3-in. tee fitted to the nipple. The horizontal outlet of the tee is reduced to ¾ in. and joined by a ¾-in. nipple to a ¾-in. gate valve, which in turn is joined to a 1½-in. hydraulic water line. One ¾-in. union is required to make this connection. The vertical outlet of the 3-in. tee is reduced to 1½ in. and three wooden plugs are made to fit tightly into the 1½-in. pipe and bored with ⅜, ½, and ⅝-in. holes. The two units are assembled and connected to the 1½-in. hydraulic-water supply. This must be an independent line with a constant head of at least 20 ft. The table pulp passes into box A and is distributed two or three inches below the surface of the water by the tin cylinder C to prevent foaming. The amount of feed water is regulated by changing the wooden plugs until the proper regulation is obtained. This classifier will handle about 50 tons per 24 hours. The following material is needed for its construction: 20 bd.ft. T and G lumber, ⅞-in.; two 3 x 12-in nipples; two 3-in. tees; two ¾-in. gate valves; one ¾-in. union; seven ¾-in. nipples; two ¾-in. 90° ells; two 1½-in. short nipples; one 3-in. flange union; two sets of reducers 3 in. to ¾ in.; two bushings ¾ in. to 1½ in.; one 1½-in. tee; sufficient 1½-in. pipe for hydraulic-water supply line, and 4 x 4-in. lumber for framing to suit requirements; also two tin cylinders, which may be made from any suitable material available.



DETAILS OF PLUG AND CYLINDER USED IN TWO-COMPARTMENT CLASSIFIER

Additional compartments can readily be added to the classifier if desired. Only one hydraulic line and union will be needed for any number of compartments (provided there is sufficient head). It is convenient to mark the wheels of the valves at the ¼, ½ and ¾ points.

*Mining engineer, 80 Broadway, New York.
†Metallurgical engineer, James Ore Concentrator Co., Newark, N. J.

Cost of United Eastern Refinery*

The refinery of the United Eastern Mining Co. at Oatman, Ariz., is 33 x 45-ft. in area and is constructed of hollow concrete-block walls, steel roof trusses and corrugated-iron covering. It is equipped with two Merrill 36-in., 32-frame precipitation presses, one Case roasting furnace, two 11 x 22-in. muffles and one Case tilting crucible furnace. The cost of construction and equipment is given in the accompanying table.

COST OF UNITED EASTERN REFINERY

	Labor	Material	Total
Plastering	$18.62	.....	$18.62
Excavation	149.75	.....	149.75
Concrete	808.06	$498.22	1,306.28
Machinery, f. o. b. Oatman	.....	1,439.14	1,439.14
Machinery, erection	213.24	90.73	303.97
Building lumber, f. o. b. Oatman	.....	68.06	68.06
Lumber framing and erection	358.20	5.50	363.70
Building covering in place, includes steel trusses	62.00	1,007.22	1,069.22
Doors and windows in place	141.75	147.76	289.51
Tank, f. o. b. Oatman	.....	53.35	53.35
Piping, f. o. b. Oatman	.....	219.14	219.14
Piping, erection	9.56	.....	9.56
Electric wiring, f. o. b. Oatman	.....	31.75	31.75
Electric wiring, erection	46.62	.....	46.62
Engineering, field	63.10	.....	63.10
Furniture and fixtures	3.37	109.58	112.95
Painting	68.13	5.96	74.09
Concrete blocks	151.12	12.00	163.12
Small tools and equipment	.....	7.20	7.20
Total refinery	$2,093.52	$3,695.61	$5,789.13

Precipitation presses were not charged in this account. The Merrill contract did not specify separate prices, and two precipitation presses and one clarification press and zinc feeder were charged to mill. The charge was: Three presses and zinc feeder, $8,450; freight, $439.20; hauling, $126; total, $9,015.20.

A 16 x 16-ft. tank outside the refinery receives the barren solution from the presses. From this sump it is pumped to the mill-solution supply tank by a 2½-in. Krogh centrifugal pump, direct connected to a 7½-hp. General Electric motor.

Magnesia Furnace Lining

Discussing some experiments in the installation of monolithic linings of magnesia in ferroalloy furnaces, R. C. Gosrow summarizes the following points in *Metallurgical and Chemical Engineering*, Oct. 1, 1917: (1) After cleaning out some of the highly heated material, the test disclosed considerable ferrous oxide and a honeycombed structure, which resembled incipient fusion and decreased in volume. (2) It was considered that the mix was too high in iron oxide. (3) Hand ramming is difficult to give uniform density on so great a volume of material. Air rammers would be more desirable. (4) The lining walls were too thick, not allowing the effect of the heat to penetrate rapidly enough to burn and frit the whole wall. The inner wall was burned hard, but halfway through the material had no bond and was destructible and soluble, which was evidenced by the sloughing effect. (5) Precautions are necessary to make hard and dense the material over openings, so that this material will not slough and fall down on the electrode, short-circuiting the current through the lining. (6) Rapid heating after burning out tar, and rapid heating to a maximum temperature appeared essential. (7) The tests showed the desirability of using other binders than tar and the futility of carrying on an experiment in apparatus necessary to plant operation.

These results show some causes of the failure of monolithic linings to give satisfaction. The author claims to have had considerable success in the last two years in the application of monolithic basic linings for ferroalloy furnaces and other basic smelting processes for tungsten, molybdenum, and manganese.

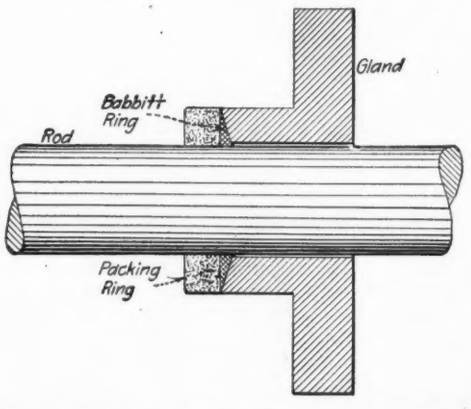
*Excerpted from a paper entitled "The United Eastern Mining and Milling Plant," by Otto Wartenweiler, to be presented at the February meeting of the American Institute of Mining Engineers at New York.

Guarding a Copper Refinery

At one of the large Eastern copper refineries the plant-patrol department consists of 35 men, each working in nine-hour shifts. This force is distributed as follows: One chief; one assistant chief; 10 regular patrolmen; 17 special patrolmen; one messenger patrolman; five gate patrolmen. The specials report in groups of five at 8 a.m., 4 p.m. and 11 p.m. As each shift comes on duty, five men are relieved (except between 4 and 5 p.m. and 11 p.m. and 1 a.m., when there are two shifts on duty on account of the former's time not being up, which gives the on-coming shift a good opportunity to look the plant over before the off-going shift is relieved). Several special patrolmen also act as traffic men at the entrance to the works and at the railroad crossings. The regular patrolmen change posts weekly, the same as the specials, except that instead of having three shifts reporting in groups of five each at a specified time, they are designated as patrols, Nos. 1 to 10, and are assigned to posts similarly numbered, shifting each week.

Casting a Ring on Piston Rod

The piston rod on our engine had been turned down, leaving the gland a loose fit, and trouble was experienced in keeping the packing from blowing out, writes H. Vipond in *Power*. I remedied it by casting



a babbitt ring on the rod. First I wrapped the rod with heavy paper, then wedged the gland central with the rod, put a ring of packing on the rod to babbitt against and made the job leakproof with clay. Only a little dressing up was required after the ring was cast, and it does the work satisfactorily.

Theory of Contact Catalysis was discussed by Prof. Wilder D. Bancroft, in a paper before the American Electrochemical Society, from the standpoint of adsorption upon the catalyst as the determining factor controlling catalytic action. He concludes that: (1) Only those substances which are absorbed by a solid are catalyzed by it; (2) while the catalytic action of solids may be solely the result of the increased surface concentration in some cases, this is not always the only factor; (3) a solid catalytic agent may be considered as equivalent to a solvent and may therefore displace the equilibrium; (4) as a result of selective adsorption different reaction products may be obtained with different catalytic agents; (5) a catalytic agent tends to produce the system which it adsorbs the more strongly.

Events and Economics of the War

During the week, the probe into the War Department's delay in preparing was accompanied by similar inquiries into the affairs of the Navy and the Emergency Fleet Corporation; the sugar and packing industries were also under investigation. Secretary Lansing published a series of intercepted dispatches revealing more clearly the workings of German intrigue in Argentina and neighboring countries. The Senate agreed unanimously to vote on the Oil Land Leasing Bill on Jan. 7 next. A new commercial treaty with Switzerland was signed. The opening of the new radio station at Cavite completed the chain of naval wireless stations from Washington to the Philippines.

Abroad, Lloyd George stated that Germany must make complete restoration and compensation as prerequisites of any peace discussion. The Germans gained slightly against the British at Ypres. Caillaux, formerly French premier, was placed on trial for treason; General Sarrail, the French commander of the Allied forces at Saloniki, was replaced by General Guillaumat. On the Italian front, the Italians recaptured Monte Asolone, taken by the Austrians early in the week. In Russia, the Bolsheviki opened negotiations for peace with the Central Powers at Brest-Litovsk, though various sections have rebelled against their rule. Canada has forbidden the importation of intoxicants; secession of Quebec from the Canadian union was proposed in the Quebec Assembly; the question will be voted on Jan. 8. Australia voted against conscription.

Government Ownership and Control of the World's Railways

Suggestions of Governmental control of the railways of the United States during the war, now being made by officials at Washington, lend interest to a compilation by the National City Bank of New York showing government control or ownership of the railways throughout the world. It shows that about one-third of the railways of the world are owned or controlled by the governments of the respective countries or states in which they operate, and that in Europe, Asia, Africa and the British colonies more than one-half of the lines are so owned or controlled. In some cases, notably Germany and Australia, the railways are chiefly the property of the states or sub-divisions forming the general government; in others they are the direct property of the government. In Germany, over 90% are classed as government or state railways; Austria-Hungary, 82%; Russia, 77%; Italy, 73%; Switzerland, 99%; the Scandinavian states, 44%; and France at present controls 17%, while other parts of her system have been built in part or whole by the government and are operated by railway companies, but will later revert to the government.

In Europe as a whole, 54% of the lines are classed as state or governmental railways; Asia 70%, Africa 65%, South America 31% and North America but 5%. In Australia 99%, in New Zealand 99%, in India 80% and in the British colonies as a whole, 55% are governmental. While in Great Britain none of the railroads is owned by the government, the entire system is now temporarily controlled by it for war purposes. In Canada about 5% of the railways are government owned. In China some of the railways are being constructed under agreements which will finally make them government property, and in Japan 79% of the railways are now classed as government lines. The principal countries which do not own or at least control any part of their lines are Great Britain, Spain and Turkey, though in certain of the South American countries, notably Argentina, the share of the lines owned or controlled by the government is comparatively small. The United States, though not owning or controlling any trackage in the states forming the Union, owns and operates the railway serving the Panama Canal and is building a line to develop the mineral resources of Alaska.

Engineers Should Be Organized for Civic Service

W. L. Saunders, chairman of the board of the Ingersoll-Rand Co., was one of the speakers at the meeting held in the Engineering Societies auditorium in New York, on Dec. 7, to welcome the American Society of Civil Engineers into the fraternity of the founder societies. In the course of his speech Mr. Saunders said:

"Let me tell you a true story of recent events at Washington. One of the most important laws which a Congress ever enacted is the draft law. This law wisely created district boards for the purpose of determining exemptions. These boards are courts of appeals—courts of last resort, except the President. Each state and territory has one or more district boards. Now, as this war is not only a clash of armies, but a combat between industries, it seemed plain that there were many men engaged in industrial work who might render greater service at home than in the trenches abroad, so the advisers of the President succeeded in placing an engineer upon the proposed list of members of each district board in each state in the Union. On these lists were representatives of the farmers, the legal profession, business men and representatives of labor. Here was the true position for the engineer, the man who is responsible for the creation and operation of our industries. The engineer members were selected from the organization of engineers which had been created by the Naval Consulting Board in each state and territory and through which the industrial plants had been surveyed and listed for war service. The President, acting in harmony with our system of government, a government by states, sent these lists to the state governors, asking them to revise them and make such changes in the names as each governor might deem wise. When the

lists were returned to the President more than 90% of the engineers were scratched off to give place to lawyers and others.

"It is useless for us to fume and protest at such treatment as this. It serves us right. We are not organized for civic service. We are not organized for any service. Our institutes, societies and our Engineering Council suffer too much from professional megalomania. Such organizations as we have are not framed to suit the kind of government which we live under—a federation of states, counties and wards—a democracy.

"Let us hope that we begin tonight by placing the cornerstone in a structure to be reared on the lines of engineering democracy. Let us get together, not in high places only, not in the branches, but at the roots of the tree; not alone in scientific fields, but as technical men doing work as citizens, reaching into every village and every ward—a technical civic federation. Let us organize, for in organization there is the secret of greater service and power."

Western Roads Get Higher Freights on Iron and Steel

Increases in freight rates on iron and steel articles ranging as high as 40% were allowed to Western railroads on Dec. 4 by the Interstate Commerce Commission. The increases were not so great as the railroads asked. They wished to cancel commodity rates and apply fifth-class rates, which would have caused increases varying from 20 to 50%. The commission held that these were too high and allowed a varying scale of increases ranging up to 90% of the fifth-class rate. Former rates on iron and steel articles were entirely too low in Western trunk territory, the commission held, owing mainly to the depression of the Chicago-St. Paul rate in competition with water carriers. The new rates, which may be filed shortly, apply principally from Chicago, Peoria, St. Louis, Kansas City, Minneapolis, St. Paul, Duluth, and Mississippi River crossings to various Western points.

No increase is proposed in present rates from Chicago to St. Louis, and other west-bank Mississippi river cities, and the commission specifies that the new rates must not disturb the present relationships in commodity rates from Kansas City and St. Louis. The commission deferred until Apr. 4, 1918, the effective date of proposals of the principal trunk line railroads east of the Mississippi to raise joint rail and lake rates to the level of all-rail rates. Investigation of the entire water competition situation on the Great Lakes will be made.

British Increasing Munitions Output

"Nearly 10,000 workshops in Great Britain are now producing munitions of war," says the London *Times*. "Of these 5000 are establishments controlled by the Ministry of Munitions, and 150 are national factories. The output of material of all kinds is on an immense scale, but the limit has not been reached. The erection of four new national factories, at a cost of over $10,000,000, has just been sanctioned, and extensions are being carried out in many areas. Existing workshops are being enlarged; a new factory is being built for the readaptation of old boxes and packing cases from the battlefields; aircraft and instructional factories are being established; and almost every week there are demands for other varieties of building subsidiary to the production of munitions."

New Kerosene Gasifier May Solve Motor Fuel Problem

A solution of the problem of the utilization of kerosene as a motor fuel is suggested in the patent of J. E. Smith for a new kerosene gasifier. The appliance is a vaporizer and is to be made by the Kerosene Motor Appliance Co., incorporated under laws of Delaware. It can be attached to any car, making possible the use of kerosene as fuel as well as gasoline. The regular carburetor, spark plugs, etc., are used and the new gasifier is merely installed between the carburetor and the intake manifold, taking kerosene from the former and vaporizing it before its entrance into the cylinders. Vaporization is accomplished by arranging the exhaust pipes to pass around the gasifier, thus heating the kerosene and reducing it to a transparent gas.

The motor is started in the usual way by gasoline, which is held in a small additional tank, the regular tank holding kerosene. When the gasifier is hot, the kerosene is picked up automatically, the gasoline turned off, and the motor run on the gasified kerosene. Experiment has shown that about 200 starts may be made on a gallon of gasoline. It has long been known that there are more heat units per gallon in kerosene than in gasoline, and a means has been sought to utilize this lower-grade fuel in internal-combustion engines. Smoke fumes and carbon deposits have been the obstacles to overcome. The new gasifier has been evolved to produce a dry gas to explode in the cylinders with a clean exhaust.

Experiments are said to indicate a substantial saving in fuel cost. A stock touring car averaged, according to report, 15.21 miles per gal. on gasoline and when fitted with a gasifier averaged 21.5 miles on kerosene, over the same course. James H. Whiting, formerly president of the Buick Motor Co., is president of the company making the gasifier.

Daylight Bill Will Save Fuel

Fuel conservation is as vital to the success of America's and her co-belligerents' cause as food conservation, according to C. H. Larson, head of the Motor Club, and whole-hearted support should be given to the Daylight Saving Bill for that reason. The bill, soon to come before Congress, might well be called the "coal-saving bill," Larson pointed out, "because that phrase indicates its real primary purpose. If that large part of the public which still regards daylight saving as a fad could see in one pile the 300,000 tons of coal England saved by turning the clock forward in the summer of 1916, opposition would cease.

"The saving of gasoline and oil, so wisely determined upon, is simply the first step. The dimming of huge electric signs during specified hours is another. Why not take the great stride? Why should factories' output be limited and gigantic manufacturing enterprise be

handicapped that coal may be conserved for war, when the same end may be gained in much easier and much more efficient fashion? It is better, both in theory and practice, to use positive rather than negative measures. Why curtail industry to save coal when millions of pounds can be saved without that curtailment?

First Standardized Ship Begun

The keel for the first of one hundred and fifty 5000-ton standardized cargo steamships was laid at the new ship-building yard of the Submarine Boat Corporation, in New Jersey, on Dec. 20. The yard has been 70% completed in 76 days. It is said to be the largest in the world, though described by H. R. Sutphen, vice president and general manager, as "merely an assembling plant," where ironworkers are to rivet together plates and girders fabricated at 49 steel mills east of the Mississippi. Of the work of building hulls 18% will be done on the 28 ways building in the yard, and 82% at the fabricating plants. As the hulls are launched they will be towed to an outfitting basin within the yard, where engines and fittings will be installed.

Britain Seeks To Control Trading in Non-Ferrous Metals

The Non-Ferrous Metal Industry Bill was passed on the second reading by the House of Commons on Dec. 11. The bill, if finally enacted, will give the British government control of all dealings in non-ferrous metal and is intended to destroy German monopoly in these metals. The following important sections of the bill are reproduced:

It shall not be lawful for any company, firm, or individual after the expiration of six months from the passing of this act, or such longer period as the Board of Trade may in any particular case allow, to carry on the business of extracting, smelting, dressing, refining, or dealing by way of wholesale trade in metal or metallic ore to which this act applies, unless licensed to do so by the Board of Trade: provided, that the purchase of metal by persons for the purposes of use in their trade shall not be deemed to be dealing in such metal by way of wholesale trade where the trade carried on by the purchaser is not primarily the trade of dealing in metals.

The metals and ores to which this act applies are zinc, copper, tin, lead, nickel, aluminum, and any other non-ferrous metals and ores to which this act may be applied by order of the Board of Trade, and the expression "ore" shall include concentrates, mattes, precipitates, and other intermediate products.

Penalties of imprisonment, fine or both are provided in the bill for conducting such business without a license or for neglecting or refusing to furnish information required under the terms of the bill or for knowingly furnishing false information. John Dillon, in the course of the debate, expressed the belief that when a peace conference came, President Wilson, on behalf of the Government of the United States, would require that the bill be made ineffective.

Hoover Asks Greater Food Saving

The following additions have been made by the Food Administration to the directions on the "Home Card" given to each signer of food pledge: To the wheatless and meatless days is added a porkless day, and to each day a wheatless and a meatless meal. The consumer is urged to use sugar on the basis of 3 lb. per person per month. Hoarding in the household is not only unnecessary but it is selfish and is a cause of high prices. Propaganda against conservation and increased production is direct assistance to the enemy. As a nation we eat and waste 80% more protein than we require to maintain health. Therefore, we can reduce the amount of meat we eat without harm. We eat and waste 240% more fat than is necessary.

Lane Reviews Chemical Progress

In his report for the last fiscal year, Franklin K. Lane, Secretary of the Interior, predicts that Congress will take action to encourage leasing of water-power rights and development of new petroleum fields. In reviewing the phenomenal growth of chemical industries in the last two years, Secretary Lane states that the country now manufactures practically everything required along chemical lines. The increase in capital invested in chemical industries was, in 1915, $65,565,000; in 1916, $99,244,000; and up to September, 1917, $65,-861,000 over the preceding year. Before the war 90% of the artificial colors and dyes were imported, five or six concerns with 400 operatives producing 3300 short tons per year. Now there are over 90 enterprises, each making special colors, and 100 concerns making crudes and intermediates.

Sulphuric acid, the chemical barometer, has doubled in production. Byproduct coking doubled its capacity in the last three years. Gasoline production has increased from 35,000,000 to 70,000,000 bbl. per annum since 1914. The production of explosives and consequent consumption of nitric acid has increased enormously. The nitric acid is still made almost entirely from Chilean saltpeter, but synthetic nitrogen plants are under process of construction. Before the war 40,-000 tons of barite were imported from Germany for the manufacture of lithopone. Now five companies are producing this article from deposits in Tennessee, Kentucky, Virginia, and Missouri.

Would Discourage the Use of Gold in Making Up Payrolls

"The use of gold coin as a circulating medium leads to rapid abrasion and consequent loss of value," said Secretary McAdoo in a recent statement. "There is real economy in using currency in all ordinary domestic transactions, letting coined gold be held as security behind gold certificates and as reserve for Federal reserve notes and other forms of paper currency or for foreign exchange settlements in cases where nothing else can be used in adjusting international balances. There are some firms and corporations, however, which have been accustomed, in making up their payrolls, to use machines for counting money. While there is no objection to these machines handling silver coins, the use of gold in them in times like the present must be discouraged."

Emery Mines of Asia Minor have been closed to the Allies because of the war. Emery is an important material in the production of munitions. The island of Naxos, Greece, one of the chief sources of supply of the fine grades, has had its emery industry stimulated by the Turkish embargo.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Litigation Hinders Tin Development at Cash Creek, Virginia

The tin deposits on Cash Creek, in Virginia, are receiving the consideration of Governmental officials. The Martha Cash tin prospects are regarded by many engineers as more promising than any other known deposit of this mineral in the United States. Half a century ago the head of the Cash family died after making an oral division of the property among a number of heirs. Deeds were not drawn and upon the discovery of float tin, disputes as to title arose. Some prospecting was done, however, and several veins of cassiterite and tungsten-bearing ores were opened. The engineers making the examinations were of unanimous opinion that the deposits possessed great promise. This led to intense competition for options and the disputes as to title took on the proportions of a family feud. Court struggles to secure possession of the more desirable parts of the property were initiated and are still in progress. Prospecting excavations have been filled and at some points the veins have been covered over.

Capital is immediately available for prospecting the properties on a large scale, provided some arrangement can be made that will guarantee against loss arising from inability to secure title. The importance of developing a tin supply in the Blue Ridge region of Virginia so near the centers of consumption, is believed by many to be such as to justify state or Federal action to secure the immediate opening of the properties. This function may be included among those of the proposed director of mining industries.

Iron and Steel Prices To Continue During Next Quarter

Present prices on iron ore, coke, pig iron, semi-finished and finished steel products will be continued until Mar. 31, 1918. After extended consideration the War Industries Board voted to the above effect, but without a preliminary conference with the interests affected, which heretofore has characterized agreements as to prices. Joseph E. Davies, of the Federal Trade Commission, and J. L. Replogle, director of steel supply, sat with the War Industries Board and advised them as to costs. The October cost report covering the production of steel, compiled by the Federal Trade Commission, had been submitted to the President previously.

Manganese Outlook for 1918

Production of domestic manganese ore will approximate 200,000 tons in 1918, according to a carefully compiled estimate furnished the War Industries Board. The estimate covers ore containing more than 40% manganese. The output of low-grade ore will depend largely on the capacity of plants to absorb the material. Some are said to be able to use rhodocrosite ores without previous preparation. One highly reliable steel maker reports that he is successfully using ore which averages 40% manganese and is high in silica, in making normal 80% ferromanganese.

Evidence is reaching Washington of a widespread feeling that the Government should take some step to reduce the risk to capital investing in manganese operations. The uncertainties of the situation are such as to preclude development on more than a hand to mouth basis. If the risk could be lessened, it is believed by several of the Government's specialists, the country could be made practically independent of foreign supplies within the next two years.

State Explosives Inspectors Meet in Washington

Whether magazines containing explosives are to be guarded is to be left entirely to state and local authorities. That the Director of the U. S. Bureau of Mines does not expect to issue any order covering this point was brought out at the meeting of state explosives inspectors in Washington last week. The inspectors were called to Washington to receive instructions with regard to the enforcement of the Explosives Act and to discuss any problems that might be presented. They were asked to encourage better construction for magazines. Burglar- and fire-proof magazines with bullet-proof roofs are so obviously desirable that it is believed companies using explosives will be willing to build them to prevent disaster.

The President's lenient attitude toward Austrians has caused hundreds to write to the Bureau of Mines asking if Austrians are now to be permitted to take out licenses. The reply is to the effect that Austrians are enemy aliens and are ineligible to receive explosives licenses.

Work of Bureau of Mines Stations

The Salt Lake City station of the U. S. Bureau of Mines is ready to make large-scale experiments in volatilizing lead and zinc, which has hitherto been confined to muffle tests. Experiments to raise the grade of oxidized zinc ores by calcination have met with some success. Work has also been started on zinc sludge with the object of recovering zinc dust used in certain processes. A series of flotation tests has also been made on silver-manganese ores.

The Berkeley, Calif., station has made arrangements with quicksilver operators, who have been coöperating with the Bureau, whereby experimental work is to be continued at one of the quicksilver plants. Plans are also being considered for the coöperation of the Berkeley and Tucson stations in experimenting with nitric acid for treating sulphide ores. The Bureau has made investigations of the nickel deposits at Nickel Mountain, near Riddle, Douglas County, Oregon.

Editorials

What Are We Going To Do About It?

WHAT American can fail to experience mortification over the revelations of the inefficiency of his country as a warring power? We are the nation that was going to do things as they ought to be done. We were going to prosecute the war with the same celerity and capability that characterized our developments in science and arts. We smiled at the slowness of our British cousins in getting their gait in warfare, at their ineptness in administration, at their waste of money and resources, and vowed that we would give them a lesson, and after nearly nine months we find ourselves as badly muddled as they were at the corresponding period. We have not even their excuse of novelty in the undertaking, for we had the teachings of three years of the experience of Great Britain and France.

It is true that we have accomplished a good deal for which we may take proper credit. We have financed our allies with promptness and generosity, we have aided them with embargoes on goods to the enemy, we have dispatched an expeditionary force to France and a naval force to British waters with surprising speed, we have adopted conscription without any fuss and have begun the organization of a great army with a minimum of delay; we have taken steps of fundamental importance in maintaining international food supply, we have repaired the interned German ships and we are well along with a great program of new naval construction. We think we may take some pride, moreover, in the Liberty motor, that is now being turned out in steadily increasing numbers.

This is our favorable report. Now for the unfavorable. Our whole system of railway transportation is creaking badly. The whole country is suffering from shortage of fuel supply. After a long period of disgraceful wrangling we have but just begun to build the ships that are so vitally needed. The arming of our new military forces is dangerously delayed. Their equipment is imperfect. The sanitary provisions for them are not what they ought to be. These facts have been disclosed in the Congressional investigation, which has shown in high quarters in the supply and ordnance departments of the Army a horrifying indecision, inability to plan, and incapacity to do things. Left to themselves the manufacturers of this country had been for three years providing the armies of Europe with rifles, machine guns, big guns, ammunition, and supplies of all kinds. We had a comfortable feeling that if our country ever should become involved in the war, these plants and this experience would be immediately available and would offset the negligence of Congress to enter upon the policy of preparedness that had been preached by prophets who had talked to deaf ears. Yet such has been the ineptness in administrative quarters that the usefulness of these manufacturing plants has been all but paralyzed. Mechanics in Connecticut have been playing checkers in working hours while officers in Washington have been debating and vacillating respecting non-essential matters. The Washington bureaus have been trying to organize the war on principles that would wreck a business enterprise. In the matter of machine guns, for example, the Browning may turn out to be the best ever, the Lewis may have failed in certain ordnance tests (the failure may have been insignificant), yet the fact remains that the British have been using it to the number of 70,000 or so, our own Navy is adopting it, and our manufacturers were ready to make it, and were not ready to make another kind. The attitude of General Crozier in this matter is like that of the lawyer who, after listening to the story of an incarcerated client, said to him: "Why, they can't put you in jail for this"; whereupon the prisoner replied: "But they did, and I'm here." It is fact vs. theory.

Now, who is responsible for this situation and what are we—the people—going to do about it? Congress is looking around for scapegoats, and doubtless they will be found and will be thrown overboard to satisfy popular clamor. But this will be simply removal of manifestations, not eradication of the trouble. Congress itself is more responsible, though it will not see it, but the real responsibility lies with the people and their leaders. The department heads are merely victims of a vicious system created by Congress in its ignorance, a system of red-tape, circumlocution and absence of business methods. The revelations lately made in the Congressional hearing are merely fragmentary. The same conditions have prevailed in many other departments, and discussion of them has been going on for months among men who know.

But while Congress may be responsible for the creation of a system, just as for the creation of a non-understandable war-profits tax law, it is not responsible for principles of action. Congress never leads and originates. It merely registers the will of the people. The real responsibility for the present muddle lies, therefore, with the people and the leaders who have misled them. They starved the railways. They decried the corporations and acted toward big business as if it were synonymous with crookedness and exploitation of the people. They excluded business methods from the executive departments. They would not listen to Theodore Roosevelt and General Wood in their preaching of preparedness. If it had not been for the persistence of those men in establishing officers' training schools things would have been far worse than they are today.

Comes the war, and the people, through their leaders, continue to ignore the principles of business, although they are embarking upon the mobilization of the nation. They disregard the experience of our allies. They do many things against which they are specifically warned. They have ideas of running a cheap war and are in such fear of profiteering that they mess things by price-fixing and the fantastic idea of annuling the law of supply and demand. They talk about the conscription of wealth and

place excessive burdens on producers. The wealth that has already been wasted outweighs by far all the fictitious economy of cheese-paring theorists. And for this the responsibility rests not upon General Crozier and the other bureau chiefs, not upon Congress, but upon the people themselves and their chosen leaders. The people have got to get out of their heads that idea of a new freedom which means the pulling down of efficiency and the following of false theories of economics, the taint of Bolshevik poison.

What is the practical remedy in the present juncture? One would be to say that the work of the Army and Navy is to fight, and that the supplying of them, and of ships, and the operation of the railways, etc., should be turned over to corporations, to be conducted as matters of business. The corporation system has proved efficient. Therefore why should not the Government make use of it? So ideal a plan must be characterized as visionary, however. What is far more probable is the creation of a department of munitions, with authority so to organize itself as to do things; the concentration within it of all the work that is now being carried on in a chaotic, irrelevant way, and the adoption by it of such business methods as are to be found, for example, in the management of the U. S. Steel Corporation. And when Congress authorizes this department, let us hope that it will confine itself to broad language and principles, and not try in the organic law to formulate precise conduct and definitions, in which it would be likely to meet with the same poor success as characterized its definition of invested capital.

Bill of Materials

WHEN a corporation is going into a new business for which it must build a plant, the first thing to be done is to have the engineering corps prepare plans for what is to be built, after which it furnishes a bill of materials, that is, an estimate of the quantity of cement, brick, lumber, steel, etc., that is needed. This estimate may be only approximate, according to the degree of study put into the preliminary plans, but, anyway, it gives the purchasing department some data on which to proceed.

In organizing the United States for war nobody appears to have prepared any kind of a bill of materials. Going further back, nobody has prepared any general plan of construction, any chart showing how many ships, aëroplanes, locomotives, railway cars, motor trucks, guns, rifles, etc., are to be built, how much ammunition is to be provided, and so on. Consequently, nobody knows definitely how much material must be secured. Vast quantities are talked about, but there is manifestly an absence of coördination. Such thought as there is runs along the line of commandeering; the Government can take all it needs, and that is all there is about it. The fascination of such dictatorial authority has obsessed the dollar-a-year civilians as well as the uniformed officers of the Army and Navy.

But this comfortable sense of power fades away when one department finds that it has commandeered what does not exist, or what may be obtained only by depriving our allies of their supplies, or that it has preëmpted what may be needed by some other branch of the Government. Thus the Navy may requisition all the tin supply and embarrass the canners who are supplying both it and the Army with food. The Navy may not really have needed the whole, but it was easier to earmark it for itself than to do any estimating of what it really needed and compare with the estimates of other departments. (This is a paraphrase of a recent actual occurrence.)

In obtaining the supply of metals, which is done through the War Industries Board, nobody knows what the Governmental consumption is going to be, and therefore producers can make no definite plans. (Even if they could the theory of price-fixing heads them off.) Last spring the Government talked about requiring a supply of lead that was far in excess of what it actually took, and upset the industry accordingly. On the other hand, plans are now being made for the use of a very essential material that is not obtainable. It may be obtained if steps for its manufacture are instituted without a day's delay. Experts have failed to get this into the head of the officer commissioned in the matter, who says simply that the material will be requisitioned!

When we have a department of munitions, if it be properly organized, the first thing that it will do will be to coördinate the estimates of the several bureaus. We think, however, that there ought to be a superior war council—a board of directors, so to speak—that would coördinate the requisitions, determine how many ships, motor trucks, locomotives, etc., ought to be built in conformity with a general scheme. Manifestly, there is no use in building motor trucks in excess of any possibility of getting them to France. The board of directors having arranged plans on definite lines, the department of munitions, as the purchasing and manufacturing organization, would secure the material in the most feasible way. The War Industries Board, the War Trade Board, the War Credit Board, the purchasing bureaus of the Army and Navy, and all the bodies that are now working at sixes and sevens, ought to be absorbed by the new department, the organization of which should be such that subordinates would be clothed with the authority to do the things that fall within their province in any private or corporate business.

War is no respecter of persons. Uncle Sam himself is not exempt from its inconveniences. This, in large measure, accounts for the slow and irregular deliveries of the *Journal* concerning which some readers have written us. Upon making a careful investigation into the causes for these complaints, our subscription department finds that the irregularities are traceable to the unprecedented congestion of the mails—due, in part, to the war program of curtailing train schedules; but mostly to the going into military service of many thousands of postal clerks. The postoffice authorities assure us that no stone will be left unturned to get back to normal service at as early a date as possible. Meanwhile, until the necessary readjustments in service are made and new clerks are trained to take the places of the enlisted men, it will be necessary to exercise a little patience. We are helping Uncle Sam all we can to deliver your paper on time.

While on the subject of thrift and cutting out useless work, work unnecessary for the prime purpose of prosecuting war, we think that the Government would do

well to take a look through its own bureaus and discover whether there be not many hundreds, or thousands, of employees who are blissfully doing the inconsequential things that constitute their "jobs" just as they did before America entered the war. Some of the published literature we receive inclines us to this opinion.

BY THE WAY

Residents of the Michigan copper country have always pointed with pride to the famous "C & H" band, composed of employees of the Calumet & Hecla mines. The following is told of a "Cousin Jack" who formerly worked at the Isle Royale mine near Hurontown. He had been West for a number of years, and, returning to Michigan, attended one of the concerts given by the C. & H. band. "M'son," he remarked to his nephew who was entertaining him, "thirty year ago, the 'Urontown band could blaw louder and longer than they."

A notable sentence uttered by Mr. Hoover while outlining what the newly formed Federal Food Board expects to accomplish was the one in which he said: "At present either the prices of food must come down or there must be a wage increase, and every time there is such an increase there is a loss of efficiency." In other words, Mr. Hoover holds that, while wages and prices act reflexively, an advance of either necessitating an advance of the other in endless progression, as the process goes on there is a loss, not a gain, in production. He had in mind, presumably, says the New York *Times*, the truth which Macaulay, almost a hundred years ago, was not the first to recognize—the truth which "labor" always does deny and others would like to deny, but cannot—the truth that men do not work with a diligence proportioned to their remuneration. What they really do, as a rule that has, of course, its exceptions, and not a few of them, is to work just as much as, and no more than, is required for earning the money they must have to satisfy their conscious wants and to live as they want to live. That amount of remuneration attained, the common human tendency is to be idle until the money is spent. This tendency is more obvious in the lower than in the higher ranks of labor, but it exists in them all—and perhaps it is not absent, but only better hidden, in the very highest by the existence there of more thought about remote needs and the consequent willingness to provide for them. It is easy to understand, therefore, why Mr. Hoover aims at the cutting down of prices rather than at bringing about a sufficient amount of rise in pay to meet a constant advance in the cost of living. He thinks in terms of productivity, and it is well for us that he does.

There are 1147 stars in the service flag of the American Smelting and Refining Co. and the American Smelters Securities Co. Roger W. Straus, a director, is a lieutenant in the army. Of the officers of the company, Daniel Guggenheim and Edward Brush have each given two sons to their country, and Judd Stewart, F. H. Brownell and R. P. Reese follow with one each. The following technical men have left the various plants to join the colors: W. E. Deedy and R. R. Hasbrouch, of the engineering force of the southern department; Charles M. Brister, assistant metallurgist, John P. Phillips and William St. Clair, assayer and assistant assayer respectively, and Frederick B. Woods, electrical engineer, all of the Baltimore plant; J. C. Pape, flotation foreman, Durango plant; Arnold Hanchett and L. V. Weeks, chemists, A. Peterson, W. F. Way and R. V. Woods, draftsmen, Oliver Punshon, tracer, and W. S. Stack, smoke expert, all of the Garfield plant; W. W. Leach and R. L. Mason, chemists, Globe plant; Taylor Belcher and H. R. Hammond, chemists, Omaha plant; John Jones, assayer, Jens Jensen and Clifford De Leon, chemists, John Huntley and Herman Switzer, surveyors, Perth Amboy plant; G. C. Dewey, chemist, Charles Harsant, assayer, Selby plant; C. E. Finney, chemist, H. H. Crary, assayer, R. H. Wonnenberg and C. E. Putman, civil engineers, Tacoma plant; Franklin A. Luis, assayer, Christmas mine; L. R. Raymond, chemist, Thomas Wilkinson, assistant chemist, R. F. Kirkpatrick, draftsman, and William Elliott, mining engineer, Flat River plant; Charles E. Woodell, engineer, Imperial mine. At the Perth Amboy plant, H. H. Alexander, general manager, and G. G. Griswold, superintendent of the smelting department have each a son with the colors, and John Burleigh, freight claim agent in the New York office, has two sons in the service.

W. E. Nesom in the *Evening Post* addresses Mr. Hoover thus, with apologies to R. Burns:

Hear, Land o' Dough and brother Yanks,
From Maine to Rio Grandy's banks,
If there are wasters in your ranks,
You'll have to drop 'em,
For here is one that knows their pranks,
And means to stop 'em.

If, while at lunch, you chance to sight
A well-conditioned, portly wight
Who seems to note your every bite,
That's he, no other;
And he would curb your appetite,
Were you his brother.

Beside the miller's elevators,
Among the farmers' stores of 'taters,
In places where they can tomatoes,
You'll find him sentry,
With optics peeled for speculators,
And such like gentry.

The cook that swells her butcher's orders,
Purse-haughty "We-can-well-afford"-ers,
Landladies who concede their boarders
A second helping—
He's on their trail. And you—ye hoarders—
Hear ye his yelping?

It's told he was a miner bred,
And dug for silver, gold and lead;
But when he saw that meat and bread
Were greater treasures,
He dropped the pick, and took instead
To scales and measures.

Now by the powers o' prose and verse,
O Hoover, if thou canst disperse
The devils that beset my purse,
Both small and greater,
I'll say we might have chose a worse
Administrator!

Manganiferous Iron Ore Occurrences at Red Cliff, Colo.*

By JOSEPH B. UMPLEBY†

Two lenses of manganiferous iron ore have been developed at Red Cliff, Eagle County, Colo., by the Empire Zinc Co., while mining for zinc and pyrite. The district requires further exploration before estimates of available tonnage can be obtained, but excellent transportation and mining facilities exist.

At THIS time of taking stock of the manganese resources of the country as a war measure, the occurrence of large deposits of low-grade manganese ore at Red Cliff, Colo., is worthy of record. This manganiferous ore is not mined at present, but the rapid extension in the application of spiegeleisen in the steel industry has increased requirements for manganese ores and because of the growing cost and difficulty of importing high-grade ore from Brazil, the Red Cliff deposits should be recognized as an important national asset. During a recent investigation of several Western manganese deposits, more than three-quarters of a million tons of ore, averaging 12 to 15% manganese, 38% iron, 1 to 2% silica and low in phosphorus, were found at Red Cliff, Colo., available for transportation and so situated as to permit rapid removal at low costs.

Two Deposits Developed in Lenses Parallel to Limestone Bedding

The Red Cliff or Battle Mountain mining district[1] is on the main line of the Denver & Rio Grande R.R. at a point 20 miles north-northwest of Leadville. The manganese deposits crop out about 500 ft. up on the canyon side two to three miles below the town of Red Cliff. The principal orebodies occur as great lenses parallel to the bedding of the inclosing Carboniferous limestone, which dips 15° to the northeast. Two deposits, occurring at nearly the same stratigraphic horizon but 3500 ft. apart along the strike, have been extensively developed for zinc and pyrite. The eastern deposit has been explored continuously for 1900 ft. down the dip in the Eagle No. 2 mine, while the western deposit is opened up for 3000 ft. on an incline of 14° at Eagle No. 1, formerly the Iron Mask mine. Both of these deposits are owned and worked by the Empire Zinc Co. Ore from the Eagle No. 2 mine is delivered to the railroad by a gravity tram while a tunnel is used at Eagle No. 1 mine, through which the ore is trammed to the track level.

The position of the orebodies was determined by shallow synclines at right angles to the general strike of the formations. The synclines are now marked on the surface by pronounced recessions in the sides of the main canyon, and as three other such recessions occur along the general belt known to be mineralized, it is probable that other orebodies will be found.

The western oreshoot, although irregular in outline, is about 300 ft. wide and from 10 to 65 ft. thick. It is continuous to the lowest level, 3000 ft. down the dip, the ore consisting of intimately mixed pyrite and sphalerite in a manganiferous siderite gangue. Some galena is found on the margins of shoots and oxidation is complete from the surface for 300 ft. down the dip. This part of the shoot contains the manganiferous iron ore. Distributed through the oxide mass are occasional bunches of lead carbonate, and beneath the lower end of the deposit and extending downward beneath the blanket of sulphide ore, considerable zinc carbonate has been found.

The manganese ore deposits have not been fully developed by present explorations but the main incline seems to pass about through the center of the body. Westward drifts, now caved beyond 150 ft., have penetrated the orebody for 500 ft. and are said to be in ore at the face. Eastward the workings, now only partly accessible, extend for an equal distance in oxidized material, and an old shaft from the surface shows manganiferous iron ore on the dump. Raises indicate that the mass averages perhaps 50 ft. in thickness. Casts of manganiferous siderite widely distributed through the oxide ore clearly indicate that comparatively little transfer of material took place during its formation. Kidneys and seams of yellowish iron oxide are abundant in places and would require hand sorting if mined. In estimating the tonnage in this orebody, therefore, allowance must be made both for waste and irregularities not revealed by present exploration. However, the estimate of 500,000 tons made by J. T. Boyd, general superintendent, seems conservative and may be accepted for present purposes as representative.

Oxidation Extensive in Eastern Deposit

In the Eagle No. 2 mine the general relations are similar except that in the primary ore sphalerite and pyrite are remarkably segregated. Of two stopes less than 100 ft. apart on the same orebody, in many places 60 ft. thick, one may yield pyrite ore averaging 44% iron and the other a sphalerite ore averaging 45% zinc. Oxidation is more extensive than in the No. 1 mine. At a point 880 ft. down the 14½° incline, which starts from the end of a tunnel 520 ft. long, a raise up the dip and over the main incline opens up manganiferous iron ore for 105 ft. Eastward there is no development in this orebody, but westward and higher on the shoot 200,000 tons of fluxing ore was mined a number of years ago. It is said to have run 15% manganese, 38% iron and from 1 to 2% silica. A drift 200 ft. west from a point 400 ft. down the incline is all in manganese ore. From the comparatively small caved area that represents the removal of the 200,000 tons and the known extent of oxidation along the dip of the oreshoot, it is clear that a large tonnage of manganiferous iron ore remains in this deposit. It is not improbable that it will yield as much as the western deposit, although the basis for so definite an estimate is lacking.

*Published with the permission of the Director, U. S. Geological Survey.

†U. S. Geological Survey, Washington, D. C.

[1]Described by A. H. Means, "Geology and Ore Deposits of Red Cliff, Colo." Economic Geology, Vol. 10, pp. 1-27, 1915.

In conclusion, it seems highly probable that Red Cliff is capable of yielding 750,000 tons of ore containing 12 to 15% manganese, 38% iron, and 1 to 2% silica. With additional tramming capacity and further preliminary development, a large daily tonnage of manganiferous iron ore can be shipped from the district.

Government Miners' Training Schools in South Africa*

The systematic training of miners which is being conducted by the British government in South Africa affords an opportunity for the younger generation to acquire a knowledge of mining while earning a sufficient wage to defray expenses. The work has been carried on at the Wolhuter School, at Johannesburg, for the past five years, and recently another school was established at the Bantjes Mine, where arrangements have been made to train 50 apprentices. The Government purposes to establish additional schools as they are needed. Apprentices under 16 years old are not accepted. Those seeking instruction must be of good physique and must go before the medical bureau appointed under the Miners' Phthisis Act for examination before being allowed underground. The course of training consists of two years' practical work underground, which embraces all the more important branches of mining work, with two periods of two weeks each in the fitting shops on surface, and evening lectures two or three times a week, with written examinations periodically. It will thus be seen that apprentices gain not only a sound knowledge of practical mining but also a useful training, a general education, elementary mathematics, and the theory of mining. Physical-culture classes and other healthful forms of recreation are provided, and, as the apprentices reside in the school buildings and are at all times subject to the discriminating supervision of the principal, parents and guardians may rest assured that every care is taken to promote their welfare.

Since the establishment of the schools, in July, 1911, 302 apprentices have matriculated, coming from Johannesburg, Transvaal, Cape Province, Orange Free State, and Natal. Of these, 17 apprentices have qualified, the others having only partly completed the work or left before the termination of the service period. The undertaking of military operations in German East Africa resulted in many apprentices joining the colors.

Men Wanted for Ground Personnel of Navy's Aviation Service

For the further extention of the aviation branch of the U. S. Navy, Secretary Daniels has authorized the enlistment of 8000 young men. There is immediate need for mechanicians for naval aviation for the ratings of machinists' mates, carpenters' mates, quartermasters, coppersmiths and blacksmiths. These men will not be enlisted for pilot's duties but will receive special training in building, handling, repairing and overhauling the navy's aircraft. On attaining proficiency they will be used as the ground personnel of the flying corps. Requirements for enrollment will be the same as those for the regular service of the U. S. Navy. The age limit for this enlistment is 21 to 35 years, and each candidate will receive the U. S. Navy physical examination and not that required for flight duties. Men enlisting for aviation duty but failing to qualify will, if recommended by their commanding officers, be assigned to general service.

*Excerpts from "Annual Report for 1916 of the Chairman of the Board of Control of the Government Miners' Training School," Johannesburg, South Africa.

Have You Joined the 27th 'Engineers' Comfort Club?

Join the Comfort Club for the 27th Engineers and start the New Year right. Get your name on the list below. Enroll yourself among those who recognize a good cause when it is presented and who will back their opinion with their money. Contributions thus far received are:

CONTRIBUTIONS TO THE COMFORT CLUB

Engineering and Mining Journal	$1000.00
New York Engineering Co	1000.00
A Friend, Nov. 23	5.00
H. H.	5.00
D. E. Charlton	5.00
H. W. Hardinge	1000.00
Frank N. Spencer	5.00
W. L. Coursen	5.00
J. H. Polhemus	5.00
J. H. Janeway	10.00
Albert D. Beers	10.00
J. E. Hayes	10.00
J. A. Van Mater	25.00
L. Vogelstein & Co	100.00
"Cuprite"	10.00
R. H. Bassett (Hanna Ore Mining Co.)	10.00
A Friend, Dec. 10	10.00
P. A. Mosman	10.00
American Zinc, Lead and Smelting Co.	100.00
J. G. H.	5.00
A Friend, Dec. 13	50.00
Daniel Guggenheim	100.00
Willard S. Morse	25.00
August Heckscher	100.00
Anaconda Copper Mining Co	1000.00
F. W. Bradley	100.00
Charles Le Vasseur	5.00
A. H. H.	5.00
Total	$4715.00

The Comfort Club has but one purpose and that is to make life as pleasant and comfortable as possible for the men of the mining regiment—the 27th Engineers, now being formed by Maj. O. B. Perry. The Club is as democratic as the war itself—all may join, from the board of directors to the toll-nipper. A check or an order payable to the *Engineering and Mining Journal* will make you a member. Start the New Year right and enroll now. The money will be spent with the aid of the regiment's officers, as occasion requires, in purchasing the little comforts of life which the Government does not provide and which often are not purchasable abroad. The money will also be used as far as possible to render any needed assistance to the families of the men in the regiment. As Mr. Bradley said in remitting:

> These men of the 27th Engineers are deserving of every comfort and consideration you have in mind for them, and I herewith enclose my check in favor of the *Engineering and Mining Journal* for $100 to help the worthy cause along.

Perhaps you have had joining the Club in mind, but through the press of business have kept putting it off. You have felt it your duty to help, but the myriad little things of the day's routine have crowded the intention aside. The miners and engineers in the regiment deserve your backing. Put yourself in their place. Send that check today.

Increase of Pig-Lead Carload Minimum to 60,000 lb. in straight carloads or in mixed carloads with certain other articles has been requested by carriers represented by F. A. Leland. This increase is in connection with domestic rates. An increase to 56,000 lb. in connection with expo rates is also asked.

Personals

Have you joined the Comfort Club for the 27th Engineers?

H. C. Wilmot has returned to New York from Arizona.

F. R. Weekes recently returned to New York from California where he was on professional business.

William Asseltine, recently with Dome Mines, South Porcupine, Ont., has taken charge of the Trethewey mill, Cobalt.

Prof. H. L. Smythe, consulting geologist for the Cleveland-Cliffs Iron Co., is in Ishpeming, Mich., on business for the company.

A. E. Drucker is in Baltimore supervising the construction and starting of a concentrating plant for the Baltimore Tube Company.

A. P. Watt, of the Missouri Metals Corporation, is in New York and is making his headquarters at the American Institute of Mining Engineers.

J. A. McAllep, formerly engineer for the Towne interests at Asientos, Aguascalientes, Mexico, is now 1st lieutenant in a regiment of engineers in France.

J. E. Looney has been advanced from the position of underground superintendent to that of general superintendent of the Zimmerman mine on the Menominee range.

H. W. Aldrich has resigned his position as superintendent of the Ladysmith Smelting Corporation, Ladysmith, B. C., to go with the Anaconda Copper Mining Company.

R. H. McDonnell, superintendent of underground-mining operations for all mines operated by the Hanna interests on the Michigan, Mesabi and Cuyuna Ranges, has enlisted in the 27th Engineers.

L. F. S. Holland, lately field engineer for the Consolidated Arizona Smelting Co., Humboldt, Ariz., has been appointed consulting engineer to the Arizona Mines and Reduction Co., Wickenburg, Arizona.

L. T. Gavin, superintendent of the mines of the American Manganese Manufacturing Co., on the Cuyuna Range, has been commissioned first lieutenant in the Engineer Officers' Reserve Corps, and ordered to report on Jan. 5 at Fort Leavenworth.

Alfred D. Flinn, deputy engineer of the Board of Water Supply, New York, has been elected secretary of the Engineering Council, secretary of the Engineering Foundation, and secretary of the United Engineering Society. Thus all "super-society" activities will center in one man.

W. H. Johnston has retired from the position of general superintendent for the Oliver Iron Mining Co., on the Marquette range, being succeeded by **F. E. Keese.** Mr. Johnston has figured largely in the industrial and political development of that region and has been on many state boards. He intends to go to Maitland, Fla., where he will make his permanent residence.

N. M. Van Brunt, for four years superintendent of the Aetna Powder Co.'s plant at Ishpeming, Mich., has left to take charge of a chemical plant for the same company in Sinnamahoning, Penn. **R. B. Smith** succeeds Mr. Van Brunt at Ishpeming. The employees of the Ishpeming plant presented Mr. Van Brunt with a watch as a token of the cordiality which governed the business relations of those concerned.

Auguste J. Rossi, of Niagara Falls, N. Y., has been awarded the Perkin medal for 1918 by the New York Section of the Society of Chemical Industry, in recognition of his work on titanium. The presentation will take place at a meeting of the Section to be held on Jan. 18, 1918, at the Chemists' Club, New York. The Perkin medal was founded in 1906 by the New York Section to commemorate Sir William Perkin, the founder of mauve.

Obituary

A. H. Purdue, state geologist of Tennessee, died on Dec. 12.

Francis G. Newlands, United States Senator from Nevada, died suddenly in Washington on Dec. 24.

Carl Henrich, mining engineer of Metasville, Ga., died at the Johns Hopkins Hospital, Baltimore, Md., after a lingering illness. He was 69 years old.

Maj. Arthur B. de Saulles, superintendent of the New Jersey Zinc Co.'s plant at Bethlehem, Penn., for nearly 23 years, died at South Bethlehem on Dec. 24, aged 78 years. He was born in New Orleans, La., and was graduated from the Rensselaer Polytechnic Institute at Troy, N. Y. He earned his title while serving as an engineer in the Confederate Army in the Civil War. Major de Saulles leaves a wife and three children, one of whom is C. A. H. de Saulles, a director of the American Smelting and Refining Co. and president of the United States Zinc Company.

Louis Pope Gratacap, curator of mineralogy in the American Museum of Natural History for the last 21 years, died suddenly at his home in New York on Dec. 19. He was born in Brooklyn in 1850 and was graduated from the College of the City of New York in 1869 and from the Columbia School of Mines in 1876. He became assistant curator in mineralogy at the Museum in 1876 and was made curator in 1900, later becoming head of the department of conchology also. His work in popular education at the Museum was noteworthy. He was the author of several books including "Geology of the City of New York" and "Popular Mineralogy."

T. D. Merton, inventor of the Merton roasting furnace, died last month in England, aged 63 years. He was born in New South Wales and began his metallurgical work there at the Clyde Chlorination Works. One of his earliest furnaces was erected at Edwards Metallurgical Chlorination Works, Ballarat, Victoria. He subsequently commenced operations on his own account in Melbourne, where he discovered a method for refining arsenic which reduced the cost considerably. Later the gold discoveries in Western Australia led to his specializing in the chlorination of West Australian ores. He soon turned his attention to roasting problems generally, and it was in this field that the earlier types of the Merton roaster were developed. The success which came to him in Australia, and the increasing demand for his furnace, ultimately led him to go to England in 1902, where he established offices which ultimately became his headquarters. He also had wide experience in mining and a close knowledge of developments in Australia.

Societies

American Institute of Mining Engineers—At a meeting of the board of directors the following nominations were submitted: For president and director, Sidney J. Jennings; for vice president and director, Robert M. Raymond and H. S. Drinker; for directors: G. C. Stone, Hennen Jennings, S. A. Taylor, F. G. Cottrell, and Arthur Thacher.

Institute of Metals (British) has announced that Sir Charles Parsons, member of council of the Institute, will give the eighth annual May lecture before the Institute next spring. His subject will be the formation of diamonds to produce which artificially he has spent 30 years in research work. An election of members was announced for Dec. 12. During the present year the Institute's membership has grown from 660 to 860. It is expected to pass the thousand mark during the coming year.

Association of Iron and Steel Electrical Engineers held its regular monthly meeting in the Hotel Chatham, Pittsburgh, Dec. 15. G. E. Stoltz of the Westinghouse Electric and Mfg. Co. presented a paper entitled, "Fly Wheels on Steel Motors." The January meeting of the Pittsburgh session will be a joint meeting with the American Institute of Electrical Engineers. Papers will be presented on generation, distribution and consumption of power, as well as power factor correction.

Colorado School of Mines has announced that the "Course for Prospectors" will be given for the fourth time from Feb. 4 to Mar. 2, 1918. This course will include lectures and laboratory work covering the subjects of common rocks and minerals, under Prof. Ziegler and Prof. Van Tuyl; chemistry, under Prof. Coolbaugh and Prof. Test; metallurgy, ore dressing and assaying, under Prof. Palmer. Lectures will also be given in general geology, including gas and oil, by Prof. Ziegler; placer mining, mining claims, and lode mining, by Prof. Wolf; and mine-safety engineering, by Prof. J. C. Roberts.

United Engineering Society's Engineering Council held a meeting on Dec. 6, in the Engineering Societies Bldg., New York. Alfred D. Flinn was elected permanent secretary for the Engineering Council, the United Engineering Society and the Engineering Foundation. The resignation of Calvert Townley, who has held office since the organization of the Engineering Council, was accepted with expressions of appreciation for services rendered. Mr. Flinn's term of office will begin Jan. 1, 1918. A report of the committee on rules was adopted, providing a method for electing to membership in the Council additional engineering and technical societies. The rules adopted are to go to the governing bodies of the four founder societies for consideration. A resolution was adopted and telegraphed to the Secretary of War urging that in administering the Selective Draft law, the Government take steps to enable qualified engineering students to continue their studies to graduation if possible, or until needed for active service.

Industrial News

Western Electric Co. announces the appointment of G. A. Schneider, formerly of its San Francisco sales organization as manager of its Buffalo house, succeeding J. W. Tabb, who has been transferred to New York.

Walter A. Zelnicker Supply Co., of St. Louis, announces that L. B. Moses has joined its organization as second vice president in charge of the rail department, with headquarters at the company's main offices in St. Louis. Mr. Moses has been sales manager of the Kettle River company of Minneapolis for the last six years.

Dry Milling Engineering Co., Denver, Colo., has been incorporated and appointed Western agents for the Raymond Bros. Impact Pulverizer Co., of Chicago. It will have exclusive agencies in the West for the automatic pulverizers, roller mills, air separators, etc., made by the Raymond company. The company will also represent the Buckeye Dryer Co. of London, Ohio, the Dust Recovering and Conveying Co. of Cleveland, and the Quigley Furnace Specialties Co., of New York. The Dry Milling company is headed by William B. Senseman, who has been employed by the Raymond company for the past eight years in erecting, operating and selling their pulverizing equipment.

Trade Catalogs

"Cut-Weld" Combination Torch, Alexander Milburn Co., Baltimore, Md., Form 1191, a circular describing an acetylene torch for cutting and welding.

Hoisting Engines, Wire Rope, Buckets, Locomotives, Cars, Trucks, Derricks, Skidders and Loaders. Walter A. Zelnicker Supply Co., St. Louis, Mo. Bulletin No. 232. Pp. 4; 3¾ x 8¾ in. A bulletin issued Dec. 11 covering articles named.

Milburn "Reliance" Light, Alexander Milburn Co., Baltimore, Md., Form 1194; a two-page circular describing a portable carbide light which, it is claimed, will give 1000 c.p. for 12 hours at less than ⅛c. per hour, and which possesses among other advantages that of being wind- and storm-proof.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Drill Chuck. Alfred Jonsson, Lidköping, Sweden. (U. S. No. 1,249,766; Dec. 11, 1917.)

Drilling—Apparatus for Drilling Holes. George H. Gilman, Claremont, N. H., assignor, by mesne assignments, to Sullivan Machinery Co., Boston, Mass. (U. S. No. 1,250,103; Dec. 11, 1917.)

Dump Car. John B. Herget, Seattle, Wash., assignor of one-half to Pauline E. Herget, Portland, Ore. (U. S. No. 1,249,624; Dec. 11, 1917.)

Electrodeposition of Metals, Apparatus for. August Leuchter, Brooklyn, N. Y. (U. S. No. 1,249,787; Dec. 11, 1917.)

Excavating and Dredging Machine. Roy E. Wilt, New Madison, Ohio. (U. S. No. 1,249,875; Dec. 11, 1917.)

Flotation Separation, Apparatus for. Charles Frank Spaulding, Salt Lake City, Utah. (U. S. No. 1,249,684; Dec. 11, 1917.)

Furnace Doors, Apparatus for Lifting. Sydney Dillon, Edgewood, Penn. (U. S. No. 1,249,605; Dec. 11, 1917.)

Furnace for Treating Ores. Gottwerth L. Tanzer, Seattle, Wash. (U. S. No. 1,249,854; Dec. 11, 1917.)

Potash—Process for Increasing the Solubility of Potash in Cement-Kiln Dust. Evald Anderson, Los Angeles, Calif., assignor to International Precipitation Co., Los Angeles, Calif. (U. S. No. 1,249,708; Dec. 11, 1917.)

Editorial Correspondence

SAN FRANCISCO—Dec. 22

Plymouth Consolidated Gold Mines, at Plymouth, has produced $2,147,833 since the property was reopened five years ago. However, the greater part of this sum has been expanded in development and equipment in addition to the original expenditure of $967,140. The cost of labor and salaries amounted to $820,000 and machinery, plant and mining supplies to $636,550. These facts were brought out in a report of W. J. Loring to Hennen Jennings, consulting engineer of the U. S. Bureau of Mines. The mine ships 135 tons of concentrates per month and receives about 50 tons of various sorts of supplies.

DENVER—Dec. 22

Colorado School of Mines Course for prospectors, which was inaugurated in January, 1915, proved so popular and profitable to those who attended, that the course has been repeated each year since. As a result of the success that attended this innovation, it has become an established part of the work of the School of Mines and will be offered annually as long as there is any apparent need or demand. The fourth annual course will be given at Golden during the four weeks beginning Feb. 4 and ending Mar. 2, 1918. It is planned to condense the work so as to keep the prospectors occupied throughout each day. This will be an advantage from the point of view of instruction and will make the course less expensive to those who attend. All of the courses will be of the most practical nature and will comprise instruction in mineralogy, elementary chemistry, principles of ore dressing, assaying, and the more common metallurgical processes; methods of valuing, buying and selling ore; placer and lode mining, location of mining claims, safety engineering. The courses are given entirely by regular members of the faculty and consist of lectures, supplemented by practical laboratory demonstrations.

BUTTE—Dec. 22

Minerals Separation vs. Butte & Superior litigation over flotation-patent infringement is to come up for hearing before the circuit court of appeals in San Francisco next month. Mining men from all over the country are interested in the outcome of this case and well-known mining lawyers have been engaged to appear in court. The result of the appeal is of great importance to the Butte & Superior company as it might have to pay an immense sum of money for use of the flotation process. Since the case was heard in the Federal court in this city all the exhibits in the suit have been in the custody of the clerk of the court and now an order has been made transferring them all to San Francisco.

Phillipsburg Manganese Production is gradually increasing. Some weeks ago the amount sent East averaged about 400 tons a day and this had been increased until now a considerably larger output is being sent out. All this is shipped to Philadelphia for treatment. In the Butte district at present no manganese is being treated, but it is an assured fact that the Butte-Detroit mill will get back to operation about the first of the year. The Emma mine of the Anaconda company is hoisting around 75 tons of manganese a day, in addition to about 150 tons of zinc ore. The manganese ore goes East for treatment. There are two properties which are being developed purely as manganese mines and both expect to be ready to ship high-grade material early in the coming year. The demand for manganese is brisk and the mining people are being urged to hurry along production with all possible speed in order that the steel companies may maintain a good supply on hand. In outside districts some manganese properties are being opened and there is hope they will be producers in a short time.

Anaconda Copper Mining Co., according to a statement issued by the officials, is practically back to normal in the output of copper. The production is now exceeding 15,000 tons of ore a day with slightly over 10,000 men at work. With the independent properties, such as the Butte & Superior, North Butte, the Clark mines, Davis-Daly, Tuolumne, East Butte and other companies, there are now 17,000 miners at work in the district, which is the largest number since last June. This clearly shows that the power and influence of the I. W. W. element is lost. The Anaconda company is not producing as much zinc as usual, due to the condition of the spelter market and to the fact that there are five months' stock of zinc concentrates at the plant in Great Falls awaiting reduction in addition to a large stock of crude ore at the Washoe zinc concentrator in Anaconda, which it is believed will keep the plant working for some time at the present rate of milling. The company was treating a considerable amount of ore from the Coeur d'Alene district, but it has been found necessary to notify the shippers that no more zinc ore will be received for the present. Despite the fact that the Anaconda company has five mines down, namely the High Ore, St. Lawrence, Belmont, East Colusa and Alice, the December production will exceed any month in the year since last June and the coming year is expected to take place alongside of 1916 for copper output according to present indications.

SALT LAKE CITY—Dec. 22

Wage Increase is announced by the Utah Power and Light Co., to go into effect Jan. 1, amounting to in round numbers an increase of $100,000 to the payroll. This increase, with that of July 1, makes a total rise in wages of 30% in six months. With the increase in wages, the company announced new working rules and the adoption of the eight-hour day for electrical workers of the company.

JOPLIN, MO.—Dec. 22

Establishment of a Rolling Mill in this district may result if a movement started at the weekly meeting of operators at Webb City comes to anything. The operators will attempt to increase the use of zinc and may finance such a project. T. F. Coyne, president of the organization, appointed a committee of three to investigate and report on the proposition.

Christmas Gifts for Employees were abandoned at the property of the American Zinc, Lead and Smelting Co. at Carterville, upon the suggestion of the superintendents, foremen and sub-foremen. A notice signed by Howard I. Young, manager of mines for this district, to all the foremen and sub-foremen at the property was posted Dec. 20, suggesting that the custom of bestowing Christmas gifts on the "bosses" be abandoned this year and that the men join the Red Cross instead. The suggestion was taken to kindly by the men, most of whom were glad to pay their dollar into the Red Cross fund.

Production Records for this district have been broken again. The Golden Rod Mining and Smelting Co. started its No. 2 mill in operation at Picher, Okla., during the week. On Dec. 19, in a 10-hour shift, the plant turned out 35 tons of concentrates, the ore showing a recovery of 31%. On Dec. 20, 48 tons of concentrates were made from ore that gave a recovery of 41%, probably the highest in the history of zinc production in this camp. On Dec. 21, the plant in 10 hours made 67 tons of concentrates, the ore this time showing a recovery of 38%. F. C. Wallower, Joplin, is manager. About one-third of the output is lead and the remainder blende. The blende assays 62% zinc and the lead concentrates 82% metallic lead, the product in each case being concentrates which command a premium.

Curtailment Of District's Output is expected as a result of the recent visit of operators to Washington. Burt W. Lyon, commissioner for the Associated Zinc Ore Producers of Joplin, returned yesterday and last night gave an interview for publication in which he said it was useless to try to cover up true conditions. He said his investigations at Washington have convinced him, there is now in this country a large amount of spelter, actual and potential. This may be called stocks or surplus, but by reason of the decreased demand for the product from the Allies, it amounts to a surplus calculated to hold down the price of spelter and zinc ore for some time to come unless there is a decided curtailment of production. Mr. Lyon reports that smelters in most cases are harder hit by the situation than are the ore producers, which is something he hardly believed before his trip East. No meeting of producers has yet been called, but it is expected some move will be made in the near future to bring about a systematic curtailment of the output from this district. It is understood the Government authorities are agreed that such a course is not only permissible but proper under the circumstances. It would mean a conservation of powder and the turning loose of workmen that could be used in other industries to advantage.

SPOKANE, WASH.—Dec. 21

Northwest Mining Convention at Spokane, will be held Feb. 11 to Feb. 17, and mining men are requested to send samples of ore for exhibition. Arrangements have been made for free transportation of the samples. The purpose in asking that ore be sent now is to give plenty of time for arrangement of the displays and also to avoid the likelihood of delayed freight trains which are frequent later in the winter. Officers of the Northwest Mining Association request that ore be sent from all promising prospects as well as from partially developed claims and mines. At previous conventions it has been noted that capital has frequently become interested in a prospect through the showing of ore.

Industrial Insurance on magnesite opertions, which employ 400 to 600 men at Valley and Chewelah, was awarded a decreased payroll premium under the state industrial insurance administration. Until this ruling was made the mining and transportation of magnesite in wagons has all been classed as quarrying, one of the heavy-risk industrial activities and 5% of the payroll has been collected to care for accidents. The commission has segregated the employments in connection with magnesite mining, so that hauling the calcined product from the kilns to the railroad is put in a lower-risk class, and only 2½% of the payroll will be collected hereafter in this department. The remainder of operations are still regarded as in the quarrying class. The commission has also put hauling of ore from metal mines, and lumber from mills, in the 2½% rate division. The new order complies with a request of the magnesite operators. Although this decision classifies magnesite operations as quarrying, such enterprises will still be regarded as mining in the popular mind.

TORONTO—Dec. 24

Issues of New Securities will be prevented by an important order-in-council, recommended by the Finance Minister of Canada, which has been passed under the authority of the War Measures Act. By this order-in-council no new issues of bonds, debentures, or other securities, of any provincial, colonial or foreign government, municipality, commission, local government, institution, corporation or incorporated company, can be issued or sold without the approval of the minister of finance by his certificate in writing. This also applies to any new issue or offering of shares whether preferred or common, of any incorporated company. It is provided that nothing in the order-in-council shall affect the trading in bonds, debentures and other securities which have already been issued and placed on the market. Any issue in contravention to the order-in-council may be restrained and heavy penalties are provided for violation of the regulations. The object of these regulations is to conserve the Canadian financial market for issues of the Dominion government bonds, and to prevent the issue of securities that may well be deferred till the end of the war. Owing to the need of credits for the Imperial government in order that the Canadian agricultural and manufactured products may find a market, the financial opinion of the country is that this regulation is necessary so the war loans may have the full benefit of the Canadian market. This will serve as a check on the issue of mining shares of a number of flotations that have been awaiting a favorable market condition, before using the sucker lists, but will not have any effect on legitimate mining enterprises.

The Mining News

ALASKA

ALASKA GASTINEAU (Juneau)—Rumor of shutdown because of heavily increasing floating debt, has been denied. President Hayes states that current assets of Alaska Gold Mines Co., the holding concern, are in excess of liabilities.

ARIZONA

G. W. P. HUNT DECLARED GOVERNOR by the Arizona Supreme Court in the contested election. Governor Campbell, who now holds the office, was given 15 days to file an appeal but he announced no further action would be taken.

Cochise County

SHATTUCK-ARIZONA (Bisbee)—Grading for new mill on Denn ground completed; concrete foundations being put in; initial capacity, 400 tons.

Mohave County

GOLD ROAD BONANZA (Oatman)—Drifting on 550-ft. level to be continued according to F. T. Torpey, president. Drift already in 400 ft. being driven to cut intersection of vein and dike about 100 ft. south. R. M. Rogers, superintendent.

Pima County

SILVER QUEEN (Tucson)—Silver Queen property owned by W. J. Bryan, Jr., optioned to A. W. McCuen, of New York, representing Morgan-Frick syndicate. Drilling begun.

ROOS AND TOVOTE, of Tucson, purchased Socorro smeltery and contemplate moving it to Tucson. H. William Stevens of Prescott, formerly president of Yuma Warrior Mining Co., also interested.

Pinal County

ARIZONA CORONADO (Price)—Sinking in vertical shaft opened at depth of 125-ft., orebody 13 ft. wide by 225 ft. long.

PINAL CONSOLIDATED (Price)—First car silver ore shipped recently. S. Hall representing the F. C. Armstrong interests, in charge.

QUEEN CREEK (Superior)—Opened 20-ft. high-grade copper orebody on 300-ft. level; 300-ft. adit to be driven on silver vein.

Yavapai County

BLACK CANYON (Turkey) — Black Canyon Mining Co. planning to erect flotation plant of about 200-tons capacity.

HILLSIDE (Hillside)—Considerable body of ore carrying 50% zinc, 6% lead, 10 oz. silver and 2% copper opened in Hillside mine. A. M. Gillespie, in charge.

ARKANSAS

NORTH ARKANSAS zinc and lead field has been in grip of blizzard for the last week. Heavy fall of snow and unusually cold weather closed down all mills, which will not start again until it thaws.

BOLD JESSE (Rush)—Operated by A. J. Mossman. Developing 12-ft. face of good milling ore.

GLORIA (Zinc)—Three cars of concentrates and three cars hand-cobbed silicate in bins. George Miller, superintendent.

ANNA MAY (Buffalo)—Temple Mining Co. has nearly completed 100-ton concentrating plant. Expect to begin production in January. Ore is zinc carbonate.

ZINC BASIN (Rush)—Development started on this mine on Clabber Creek, by Okla-Ark Mining Co. Luther Evans, member of the company and pioneer of this camp, in charge.

WILLETT (Yellville)—Liberty Lead and Zinc Co., building 100-ton concentrating plant on Willett zinc mine, near here, will complete plant within two weeks if weather favors.

CALIFORNIA

Amador County

LINCOLN CONSOLIDATED MINING CO. (Sutter Creek)—Authorized by Commissioner Carnahan to distribute $60,655 pro rata to stockholders out of any surplus profits arising from its business, accumulated and undistributed, and thereafter any excess of said sum, over the amount of such surplus profits, out of the assets of the corporation.

Inyo County

SILVER-LEAD MINES near Zabriskie are active and shipping steadily, the price of silver stimulating development. Copper and gold bearing ores also being developed.

LICENSE FOR EXPLOSIVES in Inyo County may be obtained from W. P. Yaney, Bishop; L. A. Engley, Big Pine; Jesse Hession, Independence; Cris Carrasco, Lone Pine; A. T. Smith, Keeler; Theodore Peterson, Darwin; J. E. Curran, Ballarat; Hugh Frazer, Zabriskie; F. G. Thisse, Skidoo.

STANDARD TUNGSTEN (Bishop)—Mike Zellasco fell from end of rope in an air chute, Dec. 3, receiving injuries from which he died on Dec. 8. Rope was too short, but Zellasco persisted in making descent instead of waiting for longer rope, which had been sent for.

DARWIN DEVELOPMENT CO. (Darwin)—Preparing for increased operation. Productive ground opened in Lane and Lucky Jim. Recently purchased Defiance mine and Coso water rights. Contemplating deep development; with sufficient water expect to proceed on large scale.

SALINE VALLEY SALT CO. (Keeler)—Internal differences in management being adjusted. Investigation of properties by stockholders, included F. R. Kellogg, an oil man, who may succeed to the interests of Menning and Porter. Property has 13-mile bucket tramway for transporting salt across Inyo Range while mill was in operation.

Lassen County

AT CAMP McNABB, near Doyles, copper mining and prospecting are in progress. Shipped recently two lots of copper-gold ore. Situated 16 miles north of Doyles and 2½ miles east of southern end of Honey Lake. Louis Sutter, of Honey Lake, contemplates building wagon road from his ranch on county road to camp.

Kern County

SEGOR MINING AND MILLING CO. (Los Angeles)—Permitted to issue and sell capital stock; 50,000 shares to Edward R. Fewerborn, V. M. Gelesnoff and Martin E. C. Bertrand, for purchase option on Esperanza mines, situated 40 miles northwest of Mojave in Sageland district; 50,000 shares to be sold at 30c., proceeds to be used in installation of equipment and to start operation, the milling plant to have capacity of 25 tons per 24 hours.

Mariposa County

EARLY MINING CO. (San Francisco)—Properties situated in Sweetwater district, has been permitted by commissioner of corporations to issue 79,885 shares of capital stock to L. I. Sussman and 20,000 shares to J. H. Robertson, as trustee for W. S. Arlington, in return for option and money advanced. Several claims in the group held under option in return for the stock issued. There is also a 10-stamp mill on one of the claims.

Plumas County

MARBLE CONE GOLD MINING CO. (San Francisco)—Permitted to issue 200,000 shares of stock to Walter C. Robinson, Julius H. Becker and others for placer claims on middle fork, Feather River, and in consideration for money advanced for prospecting; also to sell 60,000 shares for development. Proposed to divert stream through tunnel and operate gravel deposit in gulch. Prospecting done by diving.

San Bernardino County

WHITE FLOWER (Atolia)—Strike of high-grade scheelite on Nixon lease recently.

J. C. RAYNOR made consolidation of tungsten claims on property adjoining Atolia mines, just south of Paradox and South Side claims. Motor trucks in regular operation hauling ore from claims west of Atolia.

Trinity County

INDEX (Weaverville)—Installed new mill and chlorination plant on property at New River, formerly known as the Larsen; was producer in past but no method adopted for treatment of base ores. Now operated by San Francisco men. William J. Ivy, general manager.

Tuolumne County

CHROME MINING in Mountain Pass, Peoria Flat and Jamestown district, is prosperous. C. W. Terry and Jesse Sell producing ore from shaft 102 ft. deep in Mountain Pass. George and Thomas Richards developing promising chrome prospect in Peoria Flat. William and Frank Pereira developing in same district. William Powell and associates, of Jamestown, started work on claim on Rosasco place, near old Crimea house.

COLORADO

Chaffee County

MADONNA (Monarch)—Lessees shipping lead carbonate ore.

LILLY (Garfield)—Shipping oxidized copper ore to Salida.

ECLIPSE (Monarch)—Adjoining Madonna mine, being worked by lessees.

Clear Creek County

ONE-FORTY LEASING CO. (Georgetown)—Working portion of Seven-Thirty ground; shipments made from development; crosscutting opened feeder veins of promise.

DAILY DISTRICT, nine miles above Empire, an old silver-producing section, is being revived. Chief operation at present is work of Primos Chemical Co. on molybdenum mine at Camp Boericke.

Gunnison County

DOCTOR (Almont)—Shipping zinc-carbonate ore; production may be curtailed during winter months for development.

STAR (Crested Butte)—Shipping lead-silver ore; nine teams hauling. Will develop on deeper levels and crosscut to strike Independence vein at depth. Stated milling plant will be built next spring to treat low-grade ore. Snow may stop shipments for winter; elevation 11,500 ft., and ore must be hauled 18 miles.

Hinsdale County

SILVER FLEECE (Lake City)—Shipping silver ore.

SUNFLOWER (Lake City)—Development work being done.

GOLDEN FLEECE (Lake City)—Mill working on old tailings; flotation plant installed and operating successfully.

VERMONT (Lake City)—Being worked under partnership agreement. Long crosscut tunnel being driven to cut main vein at depth. Other smaller veins have been cut, showing good-grade ore

Lake County

CAR SHORTAGE during fall months felt all over Colorado, was especially burdensome in Leadville district; was chiefly caused by shipments of fruit and farm products; conditions now greatly alleviated.

WOLFTONE (Leadville)—Recent car shortage necessitated storage of ore. Force not reduced, but employed on development.

NISI PRIUS (Leadville)—Operations resumed; producing small tonnage iron-manganese ore. Ore shoot opened on 185-ft. level.

JAMIE LEE AND TIP TOP (Leadville)—Regular production being made from these properties, operated by Leadville Unit of U. S. Smelting, Refining and Mining Co.

DOWN TOWN MINES CO. (Leadville)—Production recently reduced on account of car shortage; this now relieved. Pumps at Penrose shaft lifting 1200 to 1500 gal. per minute.

Pitkin County

HURRICANE (Aspen)—Shoots of high-grade lead-silver ore opened; will drift 200 ft. farther to cut large shoot opened in old Chinox shaft. Will continue all winter.

PARK TUNNEL (Aspen)—Recently incorporated for 150,000 shares, par value, $1, acquired 20 claims in Turtelotte Park section, including Best Friend, Camp Bird, Edison, Iowa Chief, Justice, Jenny Lind and Silver Star. To cut this ground a 3000-ft. tunnel will be driven from head of Keno Gulch to point under Last Dollar workings. Tramway will be built to railroad

near portal of Newman adit. Old properties included have combined production of over $1,000,000 in silver.

San Miguel County

CAR SHORTAGE IN TELLURIDE DISTRICT has been relieved, and most of stored concentrates have been shipped.

LIBERTY BELL (Telluride)—Now milling large tonnage of good-grade ore from ground leased from Smuggler-Union Mining Co.

TOMBOY (Telluride)—Agreement entered into with Revenue Mines Co. whereby several claims of Revenue company, on opposite side of range in Ouray County, will be worked under lease; workings connected.

LEWIS (Telluride)—Water pumped out below third level. Planned to connect Lewis and Little Dorrit mines by crosscut tunnel. Mining and milling of ore will begin soon; concentrates will be stored for winter, as it is impracticable to keep trail open.

Summit County

MOLLIE B (Breckenridge)—Shipping gold-silver-copper ore. Bismuth ore opened in development.

CARBONATE (Breckenridge)—Shipping lead-carbonate ore from this Bald Mountain property; being worked under lease.

WELLINGTON (Breckenridge)—Milling plant running steadily; shipping lead and zinc concentrates.

FRENCH GULCH (Breckenridge)—This dredge, working in French Gulch, 2½ miles from town. Capacity of dredge, 2000 cu.yd. per day. Considerable nugget gold in clean-up.

EVANS DREDGE (Breckenridge)—Nearing completion; to have 8-ft. buckets and capacity of 4000 cu.yd. per day; electrically driven. Ground prospected by churn drilling, and dredging will begin at point north of "two-mile" bridge, north of town.

FARNCOMBE DREDGING CO. (Breckenridge)—Owns large acreage in upper Swan River Valley, at base of Farncombe Hill. Being worked under lease by Tonopah Placers Co. by dredge No. 2, a 4000-cu.yd. machine. Farncombe Hill noted for specimens of wire and crystallized gold.

Teller County

ELLA W (Cripple Creek)—Lessees shipping good-grade ore from surface discovery.

ELKTON (Cripple Creek)—Lessees shipping in both Elkton and Tornado workings.

OCEAN WAVE (Cripple Creek)—Being operated by lessees. Shaft sunk to 400-ft. level, station cut, and crosscutting to vein. Property on Battle Mountain, near Eclipse station.

IDAHO

Shoshone County

YUKON GOLD (Murray)—Dredge on Prichard Creek began operations on Dec. 6; now operating with two nine-hour shifts. Has acquired all ground along creek, about 14 miles, and if dredge proves successful, t is understood that two more will be added.

CARBONATE HILL GIANT (Mullan)—About 30 men employed erecting buildings and laying 2½-mile pipe line from old Snowstorm compressor, preliminary to beginning sinking, which will be extended to 1000-ft. depth if necessary to prove oreshoot. This property is consolidation of the former Carbonate Hill and Idaho Giant groups; new company controlled by W. D. Greenough.

NATIONAL (Mullan)—Shipped during November nine carloads of concentrates averaging 18% copper, 45 oz. silver and $1 n gold. Only half of mill running, handling from 220 to 240 tons of ore per day. Gasoline motor will replace electric for conveying ore over tram for distance of mile and a half. With gasoline motor expected to increase mill feed to 300 tons per day, and eventually will be able to supply full capacity of 500 to 600 tons daily.

HECLA (Wallace)—Outside improvements costing between $40,000 and $50,000 are nearing completion. These include ore bins with capacity of 1000 tons, new sorting plant, and large modern concrete dry and change room for miners. Shaft being extended from 1600-ft. level to 2000-ft. Oreshoot on 1600-ft. level is practically continuous for 2000 ft. Two levels will be connected and intermediate one opened. Electric haulage to be installed, using storage batteries.

MICHIGAN

Copper

WINONA (Winona)—Tributers milled in November 365 tons daily, in addition to South Lake's rock.

CALUMET & HECLA (Calumet)—Milling 9987 tons daily, of which 810 tons from Tamarack, which is working shafts Nos. 3 and 5 on day shift.

HANCOCK (Hancock)—Tonnage decreased from 1100 to 1000 tons daily, due to shortage of labor.

OSCEOLA (Osceola)—Milled 100,000 tons in November. Old Osceola will work more freely with closing down La Salle drift.

SOUTH LAKE (Lake Mine)—Improvement in copper showing this month. November tonnage 2500 as against 6000 for October, due to shutting down night shift.

NEW ARCADIAN (Houghton)—Shaft still in main lode with vertical width of 20 ft. in heavy copper with small masses; only 4° difference between inclination of shaft and lode.

NEW BALTIC (Houghton)—Has 350 ft. of good-grade ore on 275-ft. level; centering work on south drift as largest territory is in this direction and shows richer rock now.

MAYFLOWER-OLD COLONY (Houghton)—Shaft down 85 ft. using buckets and two Jackhamer drills, soon to be increased to four; foundations for shaft house laid.

MICHIGAN SMELTING (Houghton)—Installing Uniflow engine, first in this district, of 350 hp. directly connected with a 180-kw. Allis-Chalmers, direct-current generator, from Nordberg Manufacturing Co.

Iron

CARTER BROS. (Ishpeming)—Operating serpentine marble quarry near Ropes Gold mine will shortly have railroad to property permitting shipment of marble heretofore prevented by expense of team haulage. Hoose & Person, the contractors, progressing with the grading and will commence laying rails soon.

MINNESOTA

Cuyuna Range

GREAT LAKES ORE SHIPMENTS closed for season; 1917 shipments from range totaled 2,430,000 tons. Increase over 1916, 633,326 tons.

NORTHERN MINNESOTA IRON CO. (Deerwood)—Sinking exploratory shaft on Sec. 20-47-28.

HOPKINS MINE (Ironton)—Will become regular manganiferous producer on opening of shipping season. Operated by Breitung interests.

RIEDER IRON CO. (Duluth)—Have proved iron property in sec. 6-46-29; estimated tonnage is 2,000,000; shaft will be sunk 110 ft. to ore.

JOAN NO. 4 (Ironton)—Making all-rail shipments of one car daily to Chicago of high-grade manganiferous ore; will continue throughout winter.

PENNINGTON (Ironton)—Removing 150,000 cu.yd. overburden from this open-pit property preparatory to increasing next season's output.

Mesabi Range

DRAPER (Calumet)—Laying tracks for stripping. Aone unit washing plant to be constructed this winter on shores of Snow Ball Lake to take care of wash ore.

HAWKINS (Nashwauk)—Operated by Wisconsin Steel Co. for International Harvester Co. is largest in district. Shipments expected to exceed 700,000 tons for season, having mined over a million and a quarter tons, which was treated at washing plant on O'Brien Lake. Three shovels worked during summer in pit. Erecting engine house for four locomotive and carpenter shop of tile and concrete construction.

MISSOURI

Joplin District

BUTTE-KANSAS (Joplin)—At Waco, started 400-ton mill moved from Carterville. Two shafts in ore.

INSPIRATION (Baxter, Kan.)—New mill started in operation, following taking over of property by Merrill Mining Co.

YELLOWSTONE (Joplin)—Started new mill on East 15th St. in city in operation; 150-ton capacity.

U. S. SMELTING (Joplin)—Changing from gas to coal-fired boilers at Metals mine, recently purchased. Situated just south of Picher, Okla.

WACO (Joplin)—Second mill almost ready for operation; sinking deep well for drinking water and boiler purposes; two shafts into rich ore. First mill operating steadily with rich recovery.

DORRIS (Quapaw, Okla.)—Erecting mill on lease near Quapaw, entirely without plans or specifications. Second instance in district, having erected similar mill at Diamond, Mo., five years ago.

MORNING STAR (Joplin)—F. V. Wasserman, of Joplin, and associates, have taken over Muddauber mine at Belville. Renamed Morning Star; sunk shaft to 95- to 115-ft. level, and getting good recovery.

MEDICAL (Miami, Okla.)—Planning 300-ton mill on lease north of Quapaw, Okla.; 18 drill holes, most of which show ore. Shaft down to ore. Dr. E. S. Lain, president.

SCOTT (Duenweg)—Replacing mill recently lost by fire. New mill, 200-ton capacity. Equipped with double-sludge mill, operated separately. Gas used for power and plant specially protected against fire. Will erect No. 2 mill on adjoining lease soon. Haywood Scott, Joplin, president.

SENECA FAULT (Seneca)—Recently leased 2000 acres near Seneca, Wyandotte County; a subsidiary will start on Sycamore tract of 90 acres. Drills being placed and will prospect at deeper level than ever before. A. T. Estes, Pallacios, Tex., president and general manager.

MONTANA

Fergus County

BARNES KING (Kendall)—Report for November as follows: North Moccasin, ore treated, 2077 tons assaying about $9 per ton; estimated bullion production, $22,500. Gloster and Shannon in Lewis and Clark County, total ore treated 4853 tons, estimated bullion production, $62,000; shipped from Gloster, 1490 tons, assaying $6.74 per ton; from Shannon, 3044 tons, assaying $14.75 per ton. On Dec. 1, Shannon shaft reached depth of 55 ft. below 500-ft. level. Sinking at favorable rate.

Mineral County

TARBOX (Saltese)—Announced from Wallace, Idaho, office that crosscut from bottom of 800-ft. shaft cut vein 20 ft. wide, with excellent milling ore and some high-grade material, which may be sorted and shipped. Lead predominates, while in workings above zinc was in excess.

AMAZON-DIXIE (Saltese)—Situated near the Idaho line, has just completed pipe line 6000 ft. long, to provide water power for all underground work. New compressor installed, to be used jointly with old one. Tunnel 3000 ft. in length driven, 600 ft. in milling lead ore. From this level, shaft sunk 250 ft., vein crosscut showing good body of ore. With new water power company will extend shaft 250 ft. farther.

Silver Bow County

DAVIS-DALY (Butte)—Two cars of ore to Washoe works during five days of week ended Dec. 15 brought net returns of $1650 and $1250 respectively.

GREAT BUTTE COPPER CO. (Butte)—Suit instituted Dec. 14 against Great Northern Ry. to decide title to five mining claims in Silver Bow County, over which defendant has right-of-way and therefore claims interest in ores. Plaintiff asks that such claim be adjudged void.

NEVADA

Nye County

TONOPAH ORE PRODUCTION for week ended Dec. 15 amounted to 7655 tons, valued at $133,962, comparing with 10,206 tons, the previous week. Producers were: Tonopah Belmont, 2582 tons; Tonopah Extension, 2380 tons; Jim Butler, 936 tons; West End, 859 tons; MacNamara, 504 tons; Montana, 338 tons; Halifax, 55 tons; Midway, 15 tons; miscellaneous, 41 tons.

Storey County

OPHIR (Virginia)—Installed compressed-air locomotive on 2000-ft. level. Saved 40 tons in cutting out for four sill-floor sets, averaging $5.79. Andes saved 89 cars, averaging $10.30 per ton.

UNION CONSOLIDATED (Virginia)—Produced in first week of December, 353 tons, assaying $34.72, treated at Mexican mill. Sampling in 2400-ft. level showed $89.99 per ton. Other lots sampled $63.02, $51, $48.78, $45.35 per ton.

JACKET (Gold Hill)—Surface tunnel sent 200 tons to mill gloryhole. Saved 14 cars from raise in crosscut No. 5 West and 116 cars from No. 5 West gloryhole. Sunk winze 8 ft. in No. 5 East crosscut and saved 28 cars of ore. Mill working on new equipment; old cyanide plant operating; ball mill and tables operated 100 hr. Put into mill bins 322 tons of mine ore.

NEW MEXICO

CARLISLE (Steeplerock)—Operations stopped. Company may be reorganized.

LUCKY BILL (Vanadium)—Shipping regularly to smelters.

GROUND HOG (Vanadium)—Three compartment shaft to be sunk by J. B. Gilchrist. Complete outfit on property.

LAST CHANCE (Lordsburg)—Fairly. Wells and Sholly shipped two carload: high-

grade silver ore from this property under option and lease.

BONNEY (Lordsburg)—Water on 400-ft. level now under control; work will continue on ore lenses encountered in development; operated by Lawrence Mining Co.

JIM CROW (Steeplerock)—La Jara Mining Co. has given up property and stopped operations. George Utter again operating mines. Rival Mining Co. in same region installing machinery; Gold Buttes company also preparing to start up.

SOUTH CHINO COPPER CO. (Lordsburg)—Will be name of new company, formerly known as Atwood Consolidated Mining Co., operating Atwood and Southern groups of mines. Company financed in Boston; payment completed on property until January, 1917.

OREGON

STITH (Kerby)—John Lewis doing assessment work on this gold quartz mine, on Josephine Creek.

NIEL SUCCESS (Kerby)—Owned by Seattle company and managed by Richard Furth. Small crew working on gold quartz prospect; about 100 ft. of adits completed.

KERBY QUEEN (Waldo)—D. W. Collard, owner, has reopened this chrome mine, five miles northeast of Waldo. Developed by 900-ft. adit on lower level and 300-ft. on upper. Considerable tonnage of 4% copper ore on dumps; high-grade ore being shipped averaged $6 per ton gold.

SOUTH DAKOTA

Lawrence County

HOMESTAKE (Lead)—Special dividend of $1 per share will be paid with regular distribution for December. The total dividends for the year will amount to $2,210,208. Second power plant on Spearfish Creek completed; will be in commission before Jan. 1.

TROJAN (Deadwood)—Changes to lower costs and increased capacity completed; treatment plant now equipped to handle 500 tons daily. Purchased Two Johns Mine and have Republic under lease. Motor trucks used at latter to transport ore to nearest railroad point.

Pennington County

HOMELODE (Silver City)—Small mill erected during last year satisfactory. Plant will be enlarged. Diamond drilling to determine extent of orebodies.

UTAH

Beaver County

MAJESTIC MINES (Milford)—Affairs of old Majestic Copper Mining and Smelting Co., predecessor of above company, being wound up. Regular shipments of copper ore being maintained.

Juab County

TINTIC SHIPMENTS for week ended Dec. 7 amounted to 190 cars. Production for year estimated at 9900 cars of ore, or about 400,000 tons, valued at $12,000,000 in round numbers. There were shipped during 11 months just ended, 9108 cars of ore of an estimated tonnage of 364,300 tons.

IRON KING (Eureka)—Being developed, and during week ended Dec. 7 shipped first recent car of ore.

TINTIC STANDARD (Eureka)—Shipments first 11 months, 1917, were 193 cars; heaviest month was November, with 32 cars.

GRAND CENTRAL (Mammoth)—Shipments 11 months, 1917, were 432 cars, estimated at 15,000 tons. During last five months shipments averaged 32 cars monthly, going as high as 53 cars in one month.

EAGLE & BLUE BELL (Eureka)—According to present smelting arrangements able to ship about 200 tons daily.

EUREKA MINES (Eureka)—Opened 20 ft. of silver-lead ore of shipping grade on 700-ft. level.

Piute County

UTAH POTASH (Marysvale)—Shipping car of ore about every 10 days for milling at Trenton, N. J. Shipments limited by freight embargo on Eastern railroad.

YELLOW JACKET (Marysvale)—This group of 10 claims covering potash deposits acquired by the American Smelting and Refining Co., situated in Henry district, near Twin Peaks and Krotki iron mine. Former owners, J. U. and Frank Sargent.

San Juan County

KEARNS URANIUM (Thompson)—Reported warehouse to be built to store ores. Stated to have 800 tons of carnotite ore on hand. Not known whether property will be opened further.

Salt Lake County

CARDIFF (Salt Lake)—Roads between mine and ore bins at mouth of south fork of Big Cottonwood Canyon showing improvement; hauling 30 tons daily by sleds; using trucks down canyon, along which stockpiling ore.

UTAH METAL AND TUNNEL (Bingham)—Mining and shipping lead ores discontinued because of present price; confining work to copper ore; new body estimated to carry 3% copper opened on 950-ft. level. With present milling capacity, production should be about 500,000 lb. of copper monthly. Mill at present treating about 300 tons daily.

EMMA COPPER (Alta)—New fissure cut by drift to southeast from crosscut on third level from Bay City shaft, just below orebody followed 35 ft. to southwest, showing separate ore channel from that forming bodies to north. Expected from this and diamond drill indications that two oreshoots will be found to exist below third level.

OHIO COPPER (Bingham)—Estimated production for year will amount to about 5,500,000 lb. copper, with operating profit of about $500,000. Mining and milling about 2300 tons daily. Slimes treated in experimental flotation plant giving good recovery. First unit of new 3000-ton plant—600 tons—expected to be completed in about a month. Club house for employees and four new cottages at Lark completed for use of employees.

Summit County

PARK CITY SHIPMENTS for week ended Dec. 7 were 5,508,372 lb.

CALIFORNIA-COMSTOCK CONSOLIDATED (Park City)—Operated by this newly formed company, is again changing hands, it is said, and passing over to Eastern men. Consideration is given as $300,000. Under present management considerable ore opened but not enough of shipping grade. Stated to be good tonnage of milling ores.

DALY (Park City)—Preliminary figures give shipments for first 11 months of 1917, between 4000 and 5000 tons. Output held down during last few months by car shortage, embargoes, etc. At present, working forced reduced and shipments being made from ore accumulated in old stopes. Physical condition of property stated to be better than in many years.

Tooele County

WOODMAN (Gold Hill)—Shipping good-grade copper ore. New find of scheelite in raise from main tunnel.

MONOCCO (Gold Hill)—Kimball-Davis lease shipped third car of copper ore, has 100 tons more awaiting shipment. Silver ore of good grade also found.

WESTERN UTAH EXTENSION COPPER (Gold Hill)—Ore carrying gold, silver and copper opened in raise above No. 2 tunnel. Shipping-grade ore continues as raise being driven.

POLE STAR (Gold Hill)—Victor shaft down 190 ft. in ground mineralized with iron, to be continued to 250 or 300 ft., when drifting will be started. Crosscut to north from west drift in No. 1 tunnel in quartz and porphyry showing sulphides.

COPPEROPOLIS (Gold Hill)—Car of first-class ore carrying copper, silver and gold shipped, following earlier shipment of lower-grade ore. Third car of ore being prepared for market. Bambergers, of Salt Lake City, interested with N. A. Dunyon.

WESTERN UTAH COPPER (Gold Hill)—Total of 87 cars shipped during November; during early part of month shipments held down to 125 tons daily, later increased to 200 tons. Most of ore is copper; a few cars of low-grade lead-silver ore also. Test shipment of iron ore made to ascertain if it could be handled profitably.

WASHINGTON

UNITED COPPER MINING CO. (Chewelah)—Purchased Copper King mine from H. S. Wales, who recently bought property from receiver for $75,000. United company now owns a mile and a half along strike of vein.

NORTHWEST MAGNESITE (Chewelah)—Expenditures for quarry development and plant equipment will reach $450,000, according to R. S. Talbot, president. First appropriation, made over one year ago, was $250,000, but plans have since been expanded with much of additional equipment installed. Shipping six carloads daily of calcined material, weighing about half of crude. H. K. Devereaux, of Seattle, appointed general manager with headquarters at Chewelah.

WISCONSIN

Zinc-Lead District

PARSON (Dodgeville)—Sheet of blende said to be 4 to 12 in. thick, struck in drift at depth of 80 ft. by Evans Brothers, on land formerly known as Blewett farm, two miles east of Dodgeville.

NEW ROSE (Platteville)—New shaft on Brunton land being sunk; foundations laid and Mud Range mill equipment from Potosi being removed.

CANADA

British Columbia

IN EAST KOOTENAI DISTRICT, Sullivan lead-zinc property has been the largest shipper to Consolidated Mining and Milling Co.'s smeltery, at Trail, this year. Total production up to middle of November was 114,183 tons. During same period, Center Star, Le Roi and White Bear, of Rossland, shipped 89,435 tons, and Josie, of the Le Roi No. 2, in same field, 7777 tons.

Manitoba

FARAWAY (Long Lake)—Strike of gold quartz showing visible gold made in course of assessment work.

GOLD PAN (Rice Lake)—Drifting being done in quartz, showing good gold content. Pumping outfit will be installed to provide against seepage; shaft will be put down to 200-ft. level without delay.

Ontario

IN LIGHTNING RIVER DISTRICT in the Abitibi region the new gold discovery has been taken over by syndicate of Toronto men; preparing for active development. Over 200 claims staked in section but original discovery seems to be the best.

DOME (South Porcupine)—Doing only development work. Most of staff released.

PATRICIA (Boston Creek)—Also known as Boston Hollinger; shaft down 70 ft., the ore found on surface persisting at depth.

KIRKLAND PORPHYRY (Kirkland Lake)—Crosscut at 170-ft. level reached 32-ft. point from shaft in ore all the way. Shaft will be put down to 300 ft.

KERR LAKE (Cobalt)—Production during November was 205,522 oz., compared with 213,802 in October and 210,388 in September.

ELLIOTT-KIRKLAND (Kirkland Lake)—Crosscut driven to orebody at 300-ft. level shows deposit 12 ft. wide with commercial ore. Shaft will be sunk to 500-ft. level.

MILLER LAKE O'BRIEN (Gowganda)—Shipped in November, 61,960 lb. of ore. Rumored in certain quarters that this is one of the mines purchased by Thomas W. Lawson.

CANE SILVER MINES (Elk Lake)—Recently organized; developing group of claims in Cane Township. Several promising veins opened and shaft will shortly be sunk.

TEMISKAMING (Cobalt)—Making extensive preparation for developing recently acquired properties in Kirkland Lake district. Mining plant of North Dome being taken down to be transferred to Kirkland Lake.

PORCUPINE CROWN (South Porcupine)—Opened main vein at 1000 ft.; is first development below 800-ft. level for over a year; grade of ore stated to be good; ore reserves estimated at $1,000,000 and cash assets at $275,000.

McENANEY (South Porcupine)—Crosscut at 100-ft. level tapped three veins with good gold content. Diamond drilling will be undertaken to prove large 16-ft. vein at depth of 800 ft.; 150-ton mill will shortly be installed.

McINTYRE (Schumacher)—Ore reserves considerably increased by recent development at 800-, 900- and 1000-ft. levels. Drift at 1000-ft. level across McIntyre Extension entered Jupiter ground, where gold orebody reported to be 50 ft. in width. Electric-haulage system being installed at 1000-ft. level.

LA ROSE CONSOLIDATED (Cobalt)—Shareholders ratified dissolution of holding company and distribution of assets. Capital stock of operating company, the La Rose Mines, Ltd., will be reduced from $6,000,000 to $1,500,000, each shareholder of La Rose Consolidated receiving one share for each share of old stock.

MEXICO

TAMPICO DISTRICT SHIPMENTS of crude oil and petroleum products to the United States in October were 3,150,064 bbl.; from Tampico shipments were 2,494,594 bbl. and from Tuxpam, 655,470 bbl. To points other than the United States shipments in October were reported as 847,825 bbl. Gross shipments were 3,997,889 bbl.

The Market Report

SILVER AND STERLING EXCHANGE

Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
20	4.7515	86⅜	43⅛	24	4.7515	86⅛	43⅛
21	4.7515	86⅜	43⅛	25	.....	...	...
22	4.7515	86⅜	43⅛	26	4.7515	86⅛	...

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Dec.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
20	*23½	†88	6¼ @6.30	6.25 @6.35	7⅛ @7⅛
21	*23½	†88	@6.50 6.30	6.25 @6.35	7⅛ @7⅛
22	*23½	†88	@6.50 6⅜	6.30 @6.40	7.50 @7.60
24	*23½	†88	@6⅜	6.30 @6.40	7.50 @7.60
25	....	...	....	...	...
26	*23½	†88	@6½	6.30 @6.40	7.55 @7.65

† Nominal.

* Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17.5c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Dec.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
20	110	110	125	308	298	30½	54
21	110	110	125	308½	299½	30½	54
22	...	...	...	...	...	...	...
24	...	...	...	...	...	...	...
25	...	...	...	...	...	...	...
26	...	...	...	...	...	...	...

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515. £30½ = 6.4696c.; £54 = 11.4545c.; £120 = 25.4544c.; £137 = 29.0605c.; £240 = 50.9089c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—Dec. 26, 1917

All the markets were dull this week, but in those that are still competitive—lead and zinc—there were evidences of increased strength.

Copper—There is nothing of interest to report, except larger and more urgent specifications for Government account.

Copper Sheets are quoted at 31½c. per lb., f.o.b. mill, for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26½@27½ f.o.b. mill, carload lots.

Tin—None is being offered and the quotation continues purely nominal at 88c., which price would willingly be paid.

Ricard & Freiwald report stocks of tin in London and other United Kingdom ports, 4341 tons; landing and in transit, 550 tons; afloat from Australia, 54 tons. Banka or Billiton afloat to Europe and America 1636 tons. Spot or landing in United States, 1592 tons. November deliveries are reported at 1738 tons to Great Britain, 62 tons to Holland and 1400 tons to United States exclusive of Pacific port receipts.

Lead—Transactions were light, but those that were made were at better prices. There is a strong undertone to this market and a feeling that the development of more inquiry will advance the price distinctly. Transportation delays are playing an important part in local markets. Smelters report large quantities of lead accumulating at their works, sold but unshipped.

Zinc—The main feature of the week was some large sales on competitive bids to the U. S. Government. This business was for Grade C. spelter, Navy Specifications, which is something like the trade classification of "Selected," or low-grade brass special. One of these transactions, that was made public, was for 1000 tons, to be delivered over six months, which was taken at 7¼c., New York. Allowing for delivery, interest charges, etc., it was reckoned in the trade that this was equivalent to 7⅛c. for Prime Western at St. Louis. Outside of the Governmental transactions there was not much business in spelter this week, but a few round lots were reported sold to Europe.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, less 8% discount.

Other Metals

Aluminum—This market continues dull, though there is slightly greater inquiry. No. 1 ingots are offered at 37@38c. per lb., New York.

Antimony—Unchanged at 15c. for spot and 14c. for futures, c.i.f., in bond. Market very quiet.

Bismuth—Unchanged at $3.50 per pound.

Cadmium—This metal is quoted at $1.50 @1.75 per lb., depending on the quantity.

Nickel—Steady at 50c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—Unchanged at $115. Stocks in this market are very light, but there are large supplies in transit that are overdue. San Francisco reports, by telegraph, $112.50, firm.

Gold, Silver and Platinum

Silver—This market has been steady to firm with but little variation in the price. The holiday season has created dulness but the demand is likely to be revived with the opening of business after the English Boxing Day, Dec. 26, which is a London holiday.

Mexican dollars at New York: Dec. 20, 68c.; 21, 68⅛c.; 22, 68⅛c.; 24, 68⅛c.; 25, ...; 26, 68⅛c.

Platinum—In fair demand at $105 per oz.

Palladium—In brisk demand at $130@ $135.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 22 — Blende, per ton, high $71.40; basis 60% Zn, premium $70; medium to low, $60@50; calamine, basis 40% Zn, $38@35; average selling price, all grades of zinc, $54.62 per ton.

Lead, high, $81.50; basis 80% Pb, $75; average selling price, all grades of lead, $72.94 per ton.

Shipments the week: Blende, 7727 tons; calamine, 273 tons; lead, 1438 tons, Value, all ores the week, $541,810.

The larger part of the zinc shipments is on coal cars, and word was in circulation today these are to be withdrawn. All buyers are asking and insisting they receive more cars, being short their requirements while using coal cars. If these be withdrawn mining here will be greatly restricted.

Platteville, Wis., Dec. 22—Blende, basis 60% Zn, $62 base for premium grade down to $57 base for second grade. Lead ore, basis 80% Pb, $75 per ton. Shipments reported for the week are 3578 tons of zinc ore, 258 tons of lead ore, and 678 tons of sulphur ore. For the year, to date the figures are: 145,076 tons of zinc ore, 7119 tons of lead ore, and 28,015 tons of sulphur ore. Shipped during the week to separating plants, 4455 tons of zinc ore.

Other Ores

Antimony Ore—Quoted nominally at $1.75 per unit.

Manganese Ore—Metallurgical ore is unchanged at $1.20 per unit, for 48% grade, delivered to buyers.

Molybdenum Ore—Considerable business was reported at $2.25@2.30 per lb. of molybdenum sulphide, basis 90%.

Iron Ore—While at the initial agreement between the Government and the iron and steel trade, the result of which was announced Sept. 24, it was arranged that Lake Superior ore should continue at the 1917 season prices, based on $5.05 for Mesabi nonbessemer at Lake Erie dock, it was understood that the price was to be modified to the extent of any change in the Lake rate from the standard $1 rate for 1917. There is talk now in some quarters of seeking for advanced prices for the 1918 season, however. The movement down the Lakes has been barely sufficient to tide the furnaces over until the opening of navigation next year.

Upper Lake shipping ports have sent down their last iron ore cargoes and the Lake movement for the season is now estimated at 62,300,000 to 62,400,000 tons, December yielding rather a smaller total than seemed probable after the extraordinary performance in November.

Pyrites—Spanish lump is quoted at 15c. per unit, on basis of 10s. ocean freight, buyer to pay excess freight and war risk, except that concession of 2% of war risk is allowed. Ocean rates remain at 35s. for Northern, 40s. for Southern and 42s. 6d. for Gulf ports, but recent charters have exceeded these rates in several instances.

Tungsten Ore—Scheelite was sold at $26, and high-grade wolframite, at $24.50. Vigorous inquiry, both foreign and domestic, produced strength in this market.

Iron Trade Review

NEW YORK—Dec. 26

In the closing days of 1917 the steel trade has the satisfaction of knowing that it will enter the new year free from the fear that present price schedules may be overturned, says "Iron Age." The War Industries Board, after a conference on Saturday with the Federal Trade Commission, recommended to the President the indefinite extension after Jan. 1 of the prices promulgated late in September and those built upon them in the last three months.

It is expected that the President will issue a proclamation shortly extending the operation of the present schedule. Whether a definite period will be named remains to be seen, but it is believed that some readjustments will come within the next 90 days.

Recent rumors of a sentiment in a part of the Federal Trade Commission in favor of some reduction in pig iron led to a meeting of merchant producers in New York Dec. 20 at which a committee was appointed to present the case of the smaller furnaces. It was urged that a reduction in price would cause some of them to close down and only aggravate the existing famine in pig iron.

The manufacturers' committee on steel and steel products made an important announcement of additional prices this week, putting forging ingots at $73 per ton, splice bars and tie plates at 3.25c. per lb., rail steel bars at 3c., steel spikes at 3.90c., iron spikes at 4.50c., track bolts at 4.90c. and cut nails at $4 per keg.

PITTSBURGH—Dec. 24

Operating conditions in the iron and steel industry have improved slightly but are still altogether unsatisfactory. A few of the banked blast furnaces have resumed as more Connellsville coke has come through, while the byproduct ovens are working better and their attendant blast furnaces are now nearly all running. The steel works that were short of coal have been receiving somewhat better shipments, although still far from a full supply.

The restriction in output is usually exaggerated. Pig-iron production thus far in the month has averaged 75 to 80% of capacity in the central west, against an average of about 90% of capacity earlier in the year, and the output of ingots is short of capacity by a somewhat larger margin. There is question, indeed, whether the steel capacity could operate full if the blast furnaces were running full, as there has been more building of steel furnaces than of blast furnaces.

Practically the entire restriction of production in the iron and steel industry is due to insufficient freight movement, first of coke, next of coal and then of a few minor items.

There is now practically no expectation that iron and steel prices, as set under Government auspices, will be revised in the near future. The prices appear to be satisfactory to the trade and trouble might result from a downward revision and the market would certainly be disturbed.

Ordinary commercial buying of steel products has dropped to practically nothing, but Government orders are heavy and there is also considerable buying by manufacturers who have Government orders for their finished product. Commercial consumption has decreased and consumers seem to be well covered by existing contracts.

Pig Iron—If the merchant furnaces had been able to operate full during the last few weeks they would probably have a little iron to spare, but as it is they are behind in contract deliveries and have nothing to offer. Regular market buyers of pig iron seem to be fairly well supplied, but the steel works would buy considerable iron if it was to be had, to supplement their own make, which has been curtailed. The set prices continue to represent the market: Bessemer, $36.30; basic and foundry, $33; malleable, $33.50; forge, $32.50, f.o.b. furnace, the freight from valley furnaces to Pittsburgh being 95c. A sale of a round block of Alabama basic has been made for shipment to Pittsburgh, at $33, f.o.b. furnace, the freight being $4.55.

Steel—Occasionally an odd lot of soft-steel billets or sheet bars can be picked up in the open market, but the aggregate tonnage is insignificant. Discard steel arising in the manufacture of shell quality is plentiful and will be rolled to any size of billets, usually at about $2.50 discount from the set prices for soft steel. Demand for this steel is limited as it is not suited to most requirements, but consumers may modify their views when they find soft steel almost unobtainable and discard steel in such good supply. The set prices remain at $47.50 for billets, $51 for small billets, $50 for slabs, $51 for sheet bars and $57 for wire rods.

Ferroalloys

Ferromanganese — The market continue quiet, with $245 usually quoted, and sometimes shaded, for prompt or forward. The Geological Survey reports the production of manganese ore increasing rapidly, with 70,225 tons shipped in the first nine months of this year and 52,000 tons estimated for the last three months, while 1918 production is forecast at 175,000 to 200,000 tons. The last named would be nearly one-third the total requirements, assuming no imports of ore or alloy.

Coke

Connellsville — Car supplies have increased somewhat since the cold wave of a fortnight ago, but are still quite insufficient to maintain full production. The furnaces that have coke ovens of their own are on the whole suffering much more from coke shortage than are the furnaces that use purchased coke, so that price-fixing has nothing to do with this shortage. A merchant furnace in Pittsburgh was banked for a week, only 50 miles from its coke ovens, and with a five days' supply of coke lying on railroad sidings between. Set prices remain at $6 for furnace, $7 for 72-hour selected foundry and $7.30 for crushed, over 1-in. per net ton at ovens.

STOCK QUOTATIONS

N. Y. EXCH.†	Dec. 24
Alaska Gold M.	2
Alaska Juneau	2
Am.Sm.& Ref.,com.	71¼
Am. Sm. & Ref., pf.	100¼
Am. Sm. Sec., pf., A	90½
Am. Sm. Sec., pf. B.	‡96
Am. Zinc	12
Am. Zinc, pf.	35
Anaconda	56⅞
Batopilas Min.	1
Bethlehem Steel	71
Bethlehem Steel, pf.	95
Butte & Superior	15½
Cerro de Pasco	28
Chile Cop.	14⅛
Chino	39½
Colo.Fuel & Iron	33½
Crucible Steel	50¼
Dome Mines	9
Federal M. & S.	8¼
Federal M. & S., pf.	30
Great Nor., ore ctf.	24½
Greene Cananea	35½
Gulf States Steel	85
Homestake	‡90
Inspiration Con.	40½
International Nickel	27½
Kennecott	30½
Lackawanna Steel	74⅛
Miami Copper	26⅛
Nat'l Lead, com.	40⅛
National Lead, pf.	98⅛
Nev. Consol.	17
Ontario Min.	5
Quicksilver	‡.50
Quicksilver, pf.	‡
Ray Con.	20⅜
Republic I.&S.,com.	76
Republic I. & S., pf.	90½
Sloss-Sheffield	35
Tennessee C. & C.	11⅛
U. S. Steel, com.	85⅛
U. S. Steel, pf.	104½
Utah Copper	75½
Va. Iron C. & C.	48

N. Y. CURB†	Dec. 24
Big Ledge	1½
Butte & N. Y.	‡.75
Butte C. & Z.	6⅛
Butte Detroit	1/16
Caledonia	.45
Calumet & Jerome	1⅛
Can. Cop. Corpn.	1⅛
Carlisle	‡2
Cashboy	.03½
Con. Ariz. Sm.	1
Con. Coppermines	6⅛
Con. Nev.-Utah	‡ 1/16
Emma Con.	.50
First Nat. Cop.	1⅛
Goldfield Con.	.33
Goldfield Merger	.03½
Greenmonster	1/16
Hecla Min.	4⅛
Howe Sound	‡3⅛
Jerome Verde	1/16
Kerr Lake	‡4
Louisiana	.50
Magma	39½
Majestic	.29
McKinley-Dar-Sa.	.57
Milford	1½
Mohican	‡ 1/16
Mother Lode	.26⅛
N. Y. & Hond.	‡12
Nipissing Mines	8½
Nixon Nevada	1⅛
Ohio Cop.	‡
Ray Hercules	‡3⅛
Richmond	‡.56
Rochester Mines	.30
St. Joseph Lead	15
Standard S. L.	1/16
Stewart	.25
Success	.09½
Tonopah	3⅛
Tonopah Ex.	1/16
Tribullion	‡
Troy Arizona	.15
United Cop.	‡.50
United Verde Ext.	.35½
United Zinc	‡1⅛
Utica Mines	.12
Yukon Gold	1⅛

SAN FRAN.*	Dec. 22
Alta	‡.03
Andes	‡.07
Best & Belcher	‡.02
Bullion	‡.01
Caledonia	‡.05
Challenge Con.	‡.04
Confidence	‡.06
Con. Virginia	.14
Gould & Curry	‡.01
Hale & Norcross	‡.02
Jacket-Cr. Pt.	.08
Mexican	.08
Occidental	‡.60
Ophir	.04
Overman	‡.04
Savage	‡.03
Sierra Nevada	‡.13
Union Con.	.82
Utah Con.	‡.01
Belmont	2.90
Jim Butler	.72
MacNamara	.18
Midway	.05
Mont.-Tonopah	‡.10
North Star	.05
Rescue Eula	.08
West End Con.	.67
Atlanta	.07
Booth	.02
Comb. Frac.	.01
Field Daisy	‡.02
Florence	‡.09
Jumbo Extension	.13
Kewanas	‡.04
Nevada Hills	.05
Nevada Packard	‡.15
Round Mountain	‡.20
Silver Pick	.04
White Caps	‡.51
Big Jim	‡.75
United Eastern	‡3.62½

BOSTON EXCH.*	Dec. 24
Adventure	1
Ahmeek	72
Algomah	25
Allouez	45
Ariz. Com., ctfs.	10
Arnold	‡.20
Bonanza	.21
Butte-Balaklava	.25
Calumet & Ariz.	59
Calumet & Hecla	415
Centennial	12
Copper Range	42
Daly West	1⅛
Davis-Daly	4½
East Butte	8½
Franklin	4
Granby	70
Hancock	7
Hedley	‡15½
Helvetia	25
Indiana	.75
Isle Royale	21
Keweenaw	1⅛
Lake	5
La Salle	1½
Mason Valley	4
Mass	5½
Mayflower	.75
Michigan	1⅛
Mohawk	58½
New Arcadian	1⅛
New Idria	13
North Butte	12½
North Lake	.25
Ojibway	.75
Old Dominion	38
Osceola	54
Quincy	64
St. Mary's M.	49
Santa Fe	.60
Seneca	6
Shannon	5½
Shattuck-Ariz.	14
So. Lake	1⅛
So. Utah	10
Superior	4
Superior & Bost.	2½
Trinity	3½
Tuolumne	1
U. S. Smelting	43
U. S. Smelt'g, pf.	44½
Utah Apex	2
Utah Con.	9½
Utah Metal	2½
Victoria	2
Winona	1
Wolverine	31
Wyandot	.50

BOSTON CURB*	Dec. 24
Alaska Mines Corp.	.25
Bingham Mines	8½
Boston Ely	.65
Boston & Mont.	.38
Butte & Lon'n Dev.	.13
Calaveras	1
Calumet-Corbin	‡.01
Chief Con.	1 1/16
Cortes	.10
Crown Reserve	.25
Crystal Cop.	.48
Eagle & Blue Bell	2
Gila Copper	17
Houghton Copper	.60
Intermountain	.70
Iron Cap. Com.	12½
Iron Cap Cop., pf.	‡14½
Mexican Metals	.24
Mines of America	1⅛
Mojave Tungsten	.18
Nat. Zinc & Lead	.25
Nevada-Douglas	1
New Baltic	.75
New Cornelia	14½
Oneco	.25
Pacific Mines	‡.35
Rex Cons.	.10

SALT LAKE*	Dec. 18
Bannack	.26
Big Four	‡.01
Cardiff	2.50
Colorado Mining	.06
Daly	1.00
Daly-Judge	6.50
Empire Copper	1.17
Gold Chain	.14
Grand Central	.58
Iron Blossom	.60
Lower Mammoth	.03
May Day	.01
Moscow	.11
Prince Con.	.51
Rico Wellington	.18
Silver-King Coal'n	2.25
Silver King Con.	2.60
Sioux Con.	.02
So. Hecla	.70
Tintic Standard	1.45
Uncle Sam	.02
Wilbert	.17
Yankee	.02

TORONTO*	Dec. 18
Adanac	.10
Bailey	.05
Beaver Con.	.25
Chambers Ferland	.10
Coniagas	3.00
Hargraves	.08
La Rose	.43
Peterson Lake	.09
Temiskaming	.27
Wettlaufer-Lor.	.04
Davidson	.28
Dome Exten.	.09
Dome Lake	.13
Hollinger	4.90
McIntyre	1.37
Newray	.39
Porcu. Crown	.23
Teck-Hughes	.25
Vipond	.19
West Dome	.13

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Dec. 22
Cresson Con.	4.75
Doctor Jack Pot	.03½
Elkton Con.	.04½
El Paso	.15
Gold Sovereign	.02½
Golden Cycle	1.46½
Granite	.46
Isabella	.07½
Mary McKinney	.06½
Portland	1.14½
United Gold M.	.15½
Vindicator	.37

LONDON	Dec. 6		
Alaska Tre'dwell	‡£1	0s	0d
Burma Corp.	3	18	9
Cam & Motor	0	10	6
Camp Bird	0	7	0
El Oro	0	8	6
Esperanza	0	8	0
Mexican Mines	5	18	9
Min. Corp. Can.	0	16	6
Nechi, pfd.	0	9	9
Oroville	0	19	3
Santa Gert'dis.	0	13	0
Tomboy	1	0	9

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
Jan.	48.855	56.775	75.630	22.731	26.960	36.682
Feb.	48.477	56.755	77.585	22.753	26.975	37.742
Mar.	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024	76.971	23.267	31.060	39.065
July	47.519	62.940	79.010	22.597	30.000	40.110
Aug.	47.163	66.083	85.407	22.780	31.498	43.418
Sept.	48.680	68.515	100.740	23.591	32.584	50.920
Oct.	49.385	67.855	87.332	23.925	32.361	44.324
Nov.	51.714	71.604	85.891	25.094	34.192	43.584
Dec.	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601	29.962	112.432	130.000	137.455	142.000
July	23.865	26.620	95.119	128.409	125.500	140.409
Aug.	26.120	25.380	110.283	122.391	126.304	137.000
Sept.	26.855	25.073	113.905	117.500	134.071	135.250
Oct.	27.193	23.500	122.750	110.000	142.523	125.000
Nov.	30.625	23.500	134.659	110.000	155.432	125.000
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
April	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231	62.053	179.466	242.083
July	38.510	62.570	168.357	242.181
August	38.565	62.681	169.870	243.978
September	38.830	61.542	171.345	244.038
October	41.241	61.851	179.307	247.467
November	44.109	74.740	186.932	274.943
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936	11.171	6.749	11.123	31.011	30.500
July	6.352	10.710	6.185	10.644	28.137	30.500
August	6.244	10.594	6.088	10.518	29.734	30.500
September	6.810	8.680	6.699	8.611	30.786	30.500
October	7.000	6.710	6.898	6.650	30.716	30.500
November	7.042	6.249	6.945	6.187	30.500	30.500
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752	9.371	11.582	9.201	68.591	54.000
July	8.925	8.643	8.755	8.473	50.750	54.000
Aug.	8.730	8.360	8.560	8.190	51.587	54.000
Sept.	8.990	8.136	8.820	7.966	52.095	54.000
Oct.	9.829	7.983	9.659	7.813	54.159	54.000
Nov.	11.592	7.847	11.422	7.672	56.023	54.000
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound. London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95	54.22	18.95	50.05	19.34	50.14
July	21.95	57.45	18.95	53.80	19.20	53.95
August	21.95	54.17	18.95	50.37	19.22	53.95
September	22.88	46.40	19.58	42.24	19.53	48.58
October	24.61	37.25	21.26	33.95	21.51	33.95
November	30.07	37.25	28.18	33.95	26.55	33.95
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.

Volume 104 Number 26

Engineering and Mining Journal

WALTER RENTON INGALLS, *Editor*

December 29, 1917

*ILLUSTRATED ARTICLE

***Tin Dredging in Portugal** 1109

By F. W. Foote and Rastus S. Ransom, Jr.

Dredging Tin Deposits on the eastern side of Sierra Estrella Mountains, in Portugal. A 4-cu.ft. British-built dredge is used. Operations in charge of Americans. Gravel is sluiced and jigged. Concentrates are hand washed, dried and fed to an electro-magnetic separator to remove ilmenite.

Engineering and Mining Journal, Dec. 29, 1917.

Sampling Mine Floors 1111

By Albert G. Wolf.

Describing Methods for diverting the flow of water in drifts where floor samples are to be taken. Building temporary dams and flumes, and how canvas and sample bags should be used in connection therewith are discussed, and the author mentions the precautions necessary in taking floor samples.

Engineering and Mining Journal, Dec. 29, 1917.

***Design and Construction of Bucket Elevators** 1113

By Roy Reddie.

The Belt-Bucket Type of elevator when properly designed constitutes an efficient and economical means of elevating wet or dry crushed ore in a mill. Belts, buckets, head and foot pulleys, elevator boots and belt speeds require careful selection or design, dependent upon the conditions of service to be met. Many minor details of equipment are important factors in the successful operation of elevator buckets.

Engineering and Mining Journal, Dec. 29, 1917.

Some Aspects of Rand Mining 1120

Conditions in the Gold-Mining Field of Witwatersrand, the effects of war taxation of the mining industry and the imperative need for governmental relief if the business of gold mining is to survive and prosper are discussed in the annual address of Lord Harris, chairman of Consolidated Gold Fields of South Africa.

Engineering and Mining Journal, Dec. 29, 1917.

Marketing of Lead by the Smelter 1123

The Selling of the Miner's Metals by the smelter has been but vaguely understood by the miner. Some of the handicaps under which the smelter works and a general review of the methods of metal selling of one company are described in an abstract of Edward Brush's testimony in connection with the American Smelting and Refining Co. suit against the Bunker Hill & Sullivan Co. in the U. S. District Court of Oregon.

Engineering and Mining Journal, Dec. 29, 1917.

***Recovery of Comstock Tailings from Carson River** 1124

By Lewis H. Eddy.

Account of a Project to recover quicksilver and amalgam from the old Comstock tailings deposited in the Carson River and a description of a gravel conveyor and washer designed for the purpose.

Engineering and Mining Journal, Dec. 29, 1917.

Photographs from the Field 1126

Details of Practical Mining 1129

*Counterbalanced Gate and Chute Spout for Underground Ore Pockets—*Notes on Blueprinting—*Circular Rack for Blacksmith Tools.

Details of Milling and Smelting 1131

*Making an Inexpensive Classifier—Magnesia Furnace Lining—Cost of United Eastern Refinery—Guarding a Copper Refinery—*Casting a Ring on Piston Rod.

Events and Economics of the War 1133

Government Ownership and Control of the World's Railways—Engineers Should Organize for Civil Service—Western Roads Get Higher Freights on Iron and Steel—British Increasing Munitions Output—Kerosene Gasifier May Solve Motor Fuel Problem—Daylight Bill Will Save Fuel—First Standardized Ship Begun—Britain Seeks To Control Trading in Nonferrous Metals—Hoover Asks Greater Food Saving—Lane Reviews Chemical Progress—Would Discourage Use of Gold in Making Up Payrolls.

Industrial News from Washington 1136

Litigation Hinders Tin Development at Cash Creek, Virginia—Iron and Steel Prices to Continue During Next Quarter—Manganese Outlook for 1918—State Explosives Inspectors Meet in Washington—Work of Bureau of Mines Stations.

Manganiferous Iron-Ore Deposits at Red Cliff, Colo. 1140

By Joseph B. Umpleby.

Two Deposits of Manganiferous Iron Ore in the Red Cliff or Battle Mountain district of Colorado show orebodies occurring in lenses parallel to the limestone bedding and have been developed by the Empire Zinc Co. while mining for zinc and pyrite. The western deposit averages 300 ft. in width, from 10 to 65 ft. in thickness and extends 3000 ft. down the dip. The eastern deposit has been explored for 1900 ft. down the dip and shows more oxidation than the western orebody.

Engineering and Mining Journal, Dec. 29, 1917.

Editorials 1137

By the Way 1139

Personals, Obituaries, Etc. 1142

Editorial Correspondence 1143

Mining News 1144

Markets 1147

Searchlight Section 36, 37, 38, 39, 40, 41

Directory of Engineers 64

What and Where To Buy 70

Advertising Index 80

OTHER REGULAR FEATURES

MINING INDEX—Published in the first issue each month.
MONTHLY MINING DIVIDENDS—Published in the first issue each month.
CHRONOLOGY OF MINING—Published in the second issue each month.
CURRENT PRICES OF MINING SUPPLIES—Published in the second issue each month.
NEW PUBLICATIONS—Published in the third issue each month.

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CIRCULATION OF THIS ISSUE, 11,400 COPIES

America Divided

In this time of unprecedented national peril and world peril, do you want America to be one nation, strong with the strength of unity? Or do you want America split with perhaps half a dozen sections, weak with the ills and evils of sectionalism?

THIS LAST IS NO DANGER BORN OF hysterical dream. America has been committed by act of Congress to a course leading toward such a disastrous result, and this split in national life will begin July 1, 1918—unless the present law be altered.

Here is the situation:

MODERN NATIONS ARE BOUND TOgether not so much by the machinery of government as by Ideas. Fundamental ideas held in common by all, fully exchanged so that distantly placed people may understand and sympathize with each other—these are what bring a nation together and what hold it together.

THE GREATEST INSTRUMENT AND medium for the constant dissemination of these big nation-binding ideas is the press—particularly the weekly and monthly periodicals. These periodicals have not local or sectional bias; they go to all parts of America, and serve all parts alike; their great service is in helping bring all parts close together into one through a common understanding.

THESE NATION-BINDING PERIODICALS are confronted with certain injury and destruction —which means loss to you personally, and loss to your country. Postal legislation was introduced in the present Revenue Bill, and is now law, which divides the country up into "zones" and increases the average carrying charge upon magazines and periodicals about 300 per cent—as much as 900 per cent for the more remote sections of the country. This increase varies from 50 to 900 per cent.

THIS TREMENDOUS INCREASE IN RATES is not necessary for the business solvency of the Post Office Department. Last year the Post Office Department earned a surplus of nearly $10,000,000.

THIS MEASURE IS A TAX-GATHERING contrivance. *It is a tax upon ideas*—upon that spreading of ideas which hold us together and inspires us as a nation. The Post Office was never designed as a tax-gathering contrivance; it was basically designed to give service to the people—*to all the people at the same rate.* The Post Office should not be perverted from its noble purpose.

AND ANY SUCH METHOD OF TAXATION is not necessary in order to tax the publishers' profits. The publishers are not trying to evade taxation. They will gladly accept any rate of tax upon their profits that may be levied. Most of them have gone on record as being willing to turn over to the Government their *entire net profits* for the period of the war.

This measure, through its "zone" system will have the following disastrous consequences:

1. It will destroy a large part of the periodicals of the country. You will lose the magazines that have kept you informed on your country's problems, that have helped you in your work. Your children will lose the clean publications that have entertained and help educate them. And eventually such magazines as do survive will have to pass their unnecessary increase in cost on to you in case you live at a distance from any publishing center. It amounts to this: *You are fined because your occupation or your preference prevents your living in New York.*

2. Infinitely more serious, this "zone" system will result in dividing the country into sections, each developing its sectional ideas. The nation will be split into an East, a Middle West, a Pacific Coast, a South, a Southwest. And this split will be made in the world's greatest crisis, when we should be striving for union rather than disunion—when North should be bound to South and East bound to West by the constant flow of ideas—*National Ideas.*

This is the time of all times when America must be a *united* America—*one nation* strong with the strength of unity.

***Let your* influence be used to that end.**

Write your Congressman and demand the repeal of the iniquitous postal amendment

THE AUTHORS' LEAGUE *of* AMERICA, INC.

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The Manager and the Operator Shake Hands

"New Cleveland" Stopers are liked by both.

They earn dividends for the management and a record of achievement for the drill operator.

NEW Cleveland POCKET-IN-HEAD Stopers

wherever used result in—

(1) Increased Drilling
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We guarantee "New Clevelands" to give you these results in competition with other drills. If you will mail the coupon after filling in all spaces, we will send you Bulletin 35-A which describes "New Cleveland" Stopers fully, and will also tell you how you can get one of these drills on trial. Better investigate now.

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Salt Lake City, Utah—811 Walker Bank Building.
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Cleveland Pneumatic Tool Co., of Canada, Limited,
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Mail Bulletin No. 35-A and trial order blank to.....

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Position.....

Name of Mine.....

City.....

State.....

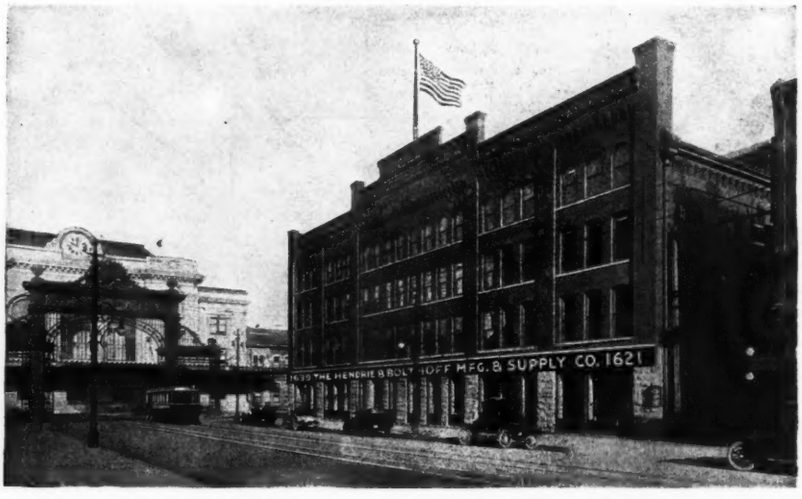
12-29-17

H&B

A NEW YEAR'S GREETING

From the

Largest Machinery and Supply House in the United States



JANUARY FIRST, 1918, will be the fifty-third New Year's Day to pass since the Hendrie & Bolthoff Mfg. & Supply Co. started business in Central City, Colo. A branch was established in Denver in 1878.

Good business principles, square dealing and hard work have made this little ' branch" the largest establishment of its kind in the United States.

The main office and store building, shown above, covers 18,000 square feet—four stories and basement.

The four brick warehouses cover an aggregate of 26,000 square feet.

The pipe warehouse 22,500 square feet; the bar iron and steel warehouses, 18,800 square feet. In additon, there is now in use about 30,000 square feet of uncovered adjoining ground piled high with steel products.

The firm uses in its delivery and shipping service:—six single wagons, seven heavy platform wagons, and seven automobile trucks.

The Hendrie & Bolthoff employes now number over 200.

The great quantity of merchandise handled by the firm is listed in the four principal catalogues: Electrical Supplies 850 pages, Automobile Supplies 175 pages, Machine Tool and Woodworking Equipment 80 pages, Milling Machinery 170 pages, and the new General Catalogue No. 48 1000 pages.

THE HENDRIE & BOLTHOFF

MANUFACTURING & SUPPLY CO.

PIONEER MACHINERY AND SUPPLY HOUSE OF THE WEST

DENVER · COLO ·

Some Big Users of Deister Simplex Tables

Inspiration Consolidated Copper Co., Miami, Arizona
Miami Copper Co., Miami, Arizona
United States Stores Co., Midvale, Utah
Pittsburgh Steel Ore Co., Riverton, Minn.
Alaska Juneau Gold Mining Co., Juneau, Alaska
Atolia Mining Co., Atolia, Calif.
Smuggler Union Mining Co., Telluride, Col.
Granby Mining & Smelting Co., Joplin, Mo.
Field Mining & Milling Co., Scales Mound, Ill.
Alaska Treadwell Gold Mining Co., Treadwell, Alaska
Bingham-New Haven Copper & Gold Mining Co., Bingham, Utah
Hollinger Gold Mines, Ltd., Timmins, Ont., Can.
Dominion Reduction Co., Cobalt, Ont., Can.
Prince Consolidated Min. & Smelting Co., Panaca, Nev.
McKinley-Darragh Savage Mines Co., Cobalt, Ont., Can.
Irtysh Corporation-Ridder Mining Co., Ridderiski, Siberia
Russo-Asiatic Corporation, Ltd., Nerchinsk, Siberia
W. L. Reeder, Johannesburg, S. Africa
The Billiton Co., Tandjong Pandan, Billiton, Dutch East India
The Seoul Mining Co., Kobe, Japan
Takata & Co., 50 Church St., N. Y., For Japan
St. Anthony Mines, Lovelock, Nev.

The New Deister Simplex Rougher and Finisher

The Reason:

Note our duplex plateau. It consists of several steps or rises along a diagonal line intermediate the dressing zone and the main concentrating portion of the deck.

Numerous Repeat Orders for Deister Simplex Tables Prove That They Make Good

Recent re-orders totaling 381 Deister Simplex Sand Tables and 172 Deister Simplex Slime Tables tell a story of satisfaction complete. Just as the proof of the pudding is in the eating so is the proof of classifying machinery in its performance—in its ability to not only show superiority in comparative tests but to maintain that showing in prolonged service. That's where Deister Simplex equipment excels—in standing the racket, in large capacity, in economy of water, in automatic control of the line of separation, in cleaner concentrate and lower tailing.

The Deister Brothers, Emil and William F., are connected with this concern exclusively. The Deister Simplex Tables are the only ones that embody the latest and best Deister inventions.

Write us in detail concerning your ore concentration problem. We can offer suggestions based on years of field experience that will be helpful to you. No obligation.

Catalog on Request.

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Incorporated July, 1912

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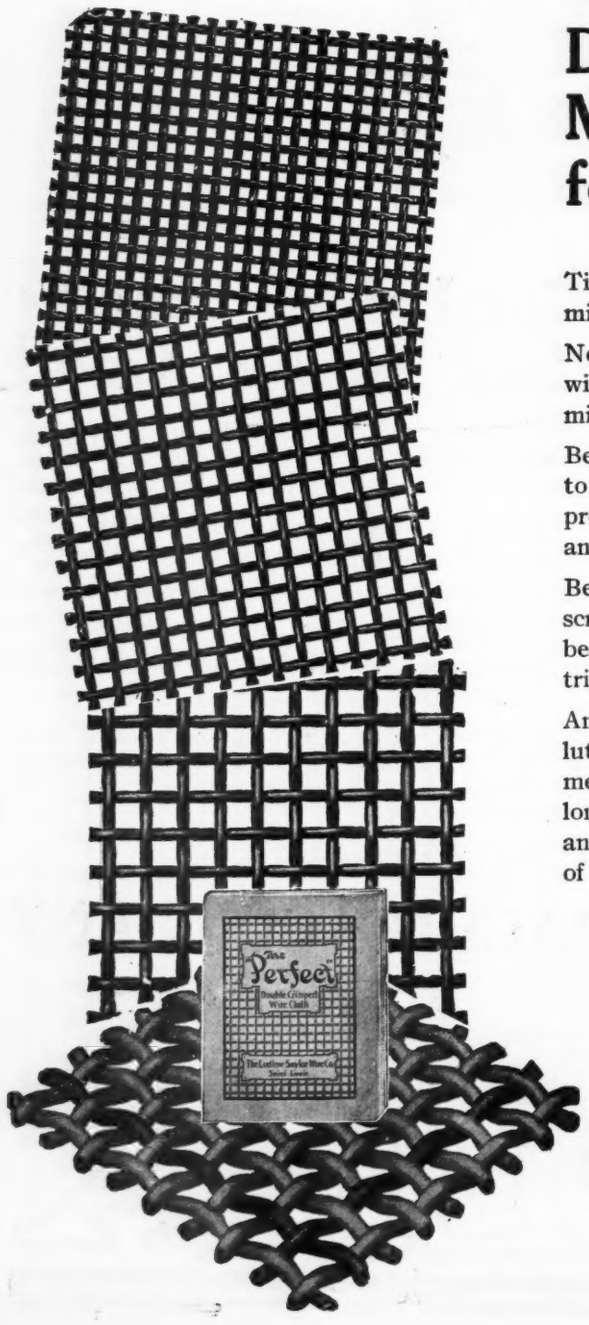
London Office:.....No. 1, London Wall Bldgs., London Wall, E. C.

Agents: William L. Reeder, 410 Consolidated Bldg., Johannesburg, South Africa. Takata & Company, 2 Yeiraku-cho, Nichome, Kojimachi-Ku, Tokyo, Japan.

SIMPLEX

"Perfect"



Double Crimped Wire Cloth Means Maximum Production for Screening Machinery

Time was when a screen was a screen in the estimation of the mine man. Any screen was considered as good as any other.

Now, due to the tendency to fine grinding and closer grading, wire screens have come to be a much more important factor in mine and mill equipment.

Because of their increased use, mining men have been awakened to the vast difference in wire screens—their effect on the quantity production of mills, on the uniformity of screened materials, and on production costs.

Because of the general effort to secure the greatest efficiency in screening, the use of "Perfect" Double-Crimp Wire Cloth has become more and more general until now there are many districts where it is used practically exclusively.

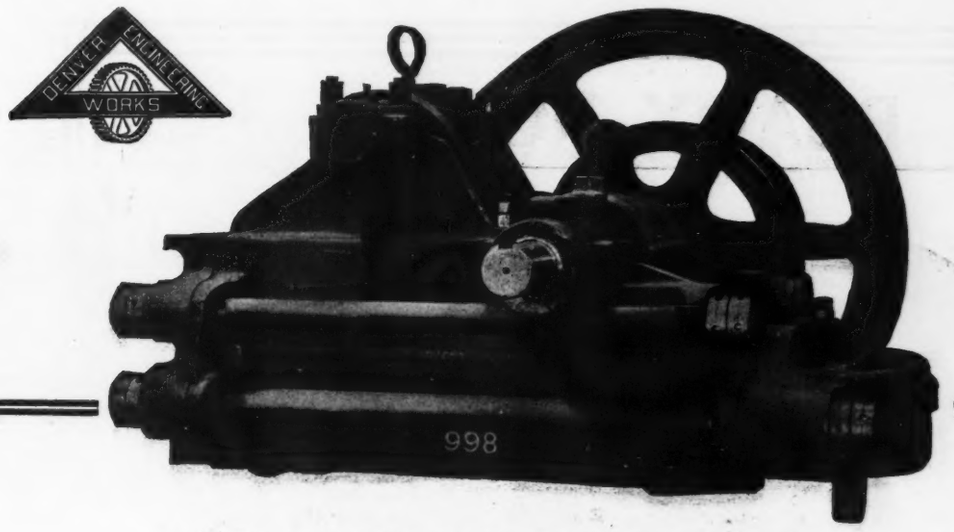
And the reason is plain. "Perfect" Screens deliver an absolutely uniform product because the double crimp prevents meshes from spreading; they are stronger, more rigid, and wear longer because of the superior wire used in their construction; and they afford increased capacity due to scientific combination of open area with maximum supporting strength.

If you have not heretofore used "Perfect" Double-Crimp Wire Cloth we earnestly urge you to make a test installation in your mine or mill. Remember, we supply it in any sized mesh and with any desired size of wires. Our experience enables us to offer valuable suggestions in response to inquiries concerning screens and their uses. Write today. No obligation. Our "Perfect" catalog is sent on request.

The Ludlow-Saylor Wire Co.

General Office and Factory: St. Louis Mo.

Branch Offices: 20 East Jackson Street, Chicago
Mills Building, El Paso, Texas
Felt Building, Salt Lake City, Utah



Side view of Blake Crusher with one flywheel removed to show tension rods and other details of construction.

No Better Machine Made for Coarse Crushing of Ores

The Blake Crusher is universally recognized as one of the most successful machines ever designed for the coarse crushing of ores.

The one we make has many improvements over other types. Chrome tempered steel jaw plates. Has safety toggle, which breaks when foreign material accidentally gets between jaws. The two heavy machine-finished flywheels insure smooth running.

Steel tension rods are used to take the severe shocks.

It is built sectional for transportation over mountains or difficult roads. This convenience in handling is something not to overlook.

Bulletin 1056 gives all the details and should be in the hands of all persons interested in ore crushers. Sent free on request.

The Denver Engineering Works Co.

3100 Blake Street ***Also Makers of*** **Denver, Colorado**

Dewco Ball Mills
Ovoca Classifiers
Electric Hoists
Mine Timber Framing Machinery
Ore Crushers
Automatic Samplers
Richards Pulsator Classifiers
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Crushing Rolls
Mine Cages
Stamp Mills
Revolving Grizzlies
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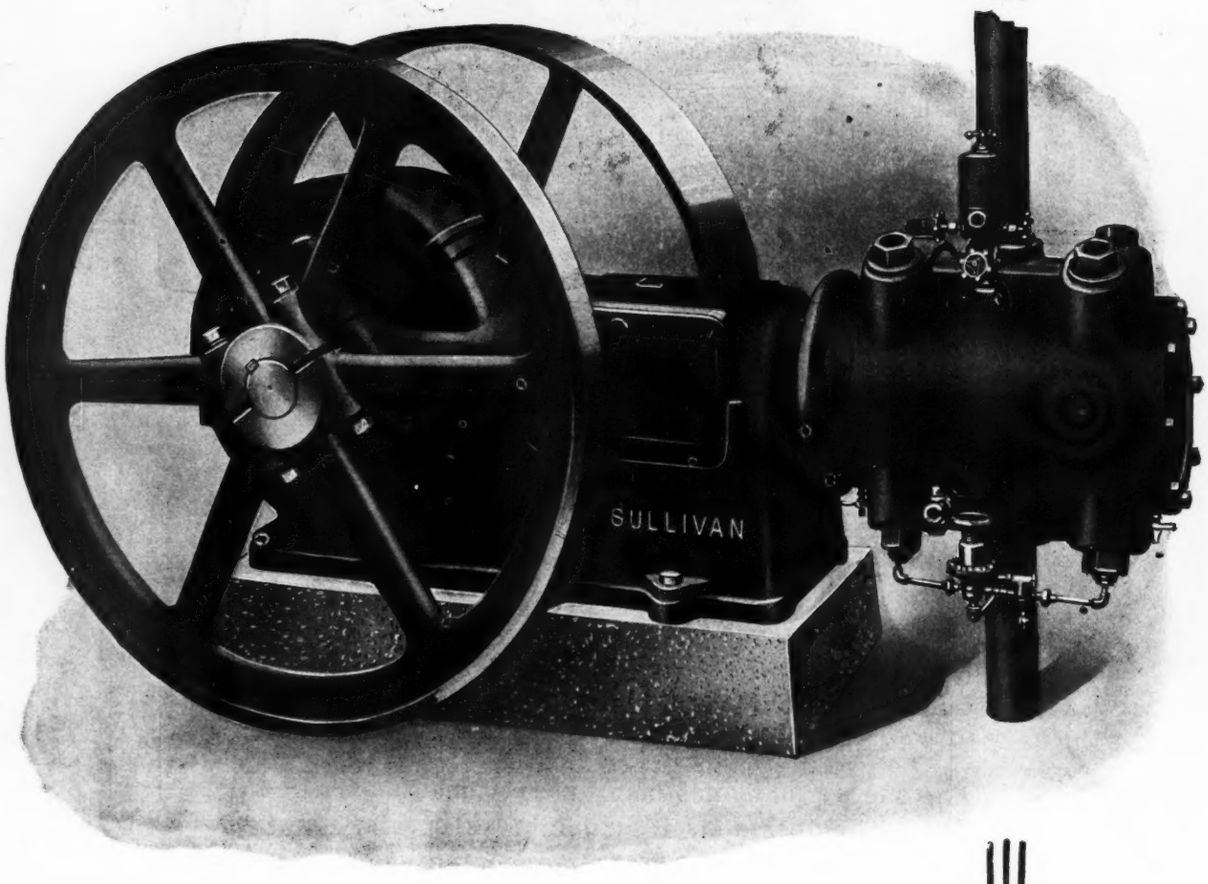


We can ship from stock these belted, straight-line

"WG-3" Sullivan Air Compressors

in several sizes, from 50 cu. ft. upward.
Prompt delivery on other sizes and types.

The "WG-3" is mounted on a sub-base, reducing foundation costs. It is belt driven, from either of the two sides. It is of the center-crank type, and practically automatic. The main working parts are enclosed in a dust-proof housing and splash-oiled. The air valves are of the radial, automatic pattern.

Simplicity, strength and economy in operation are qualities that will interest you in these sturdy SULLIVAN Air Compressors.

Ask for Bulletin 275 A.

Sullivan Machinery Company
126 So. Michigan Avenue, Chicago

The Wedge Mechanical Furnace

Patented

YOUR ROASTING PROBLEM INTERESTS US

When you are considering increased capacity or greater efficiency in roasting, or have some new process in which roasting is an important factor, we will endeavor to be of service.

Write us fully, stating analysis of ore, concentrates, mixture or material you desire to roast, characteristics and physical condition of same, number of tons to be treated per twenty-four hours, and results you desire in the calcine.

Wedge Mechanical Furnace Company

Greenwich Point, Philadelphia

RIFFLING

Increasing the Capacity of the Table You've known so well for 20 Years

There have been great changes in mining and mill equipment since the first Wilfley got on the job, 20 years ago. The Wilfley has stood the test of time —because the Wilfley principles were right.

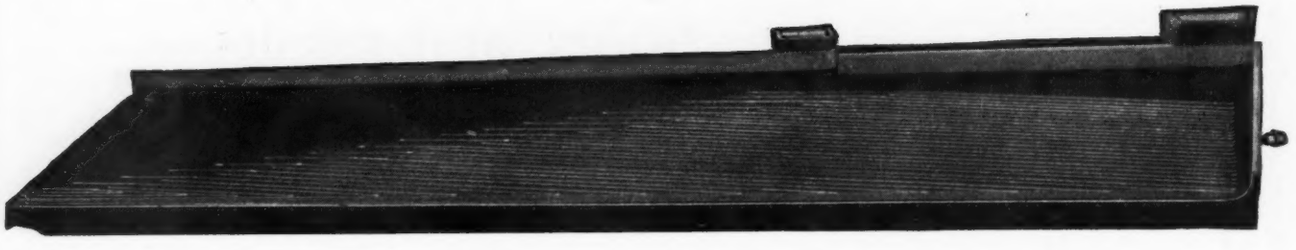
At the same time, there have been Wilfley improvements—many of them—but the Wilfley principle—concentration on a diagonal line—has survived.

The new riffling systems developed by our engineers are based on years of experience with the Wilfley Table, and mark an important advance in the concentration of ores, both in greatly increased capacity, and in cleaner separation. The No. 10 and No. 1623 Wilfley riffling systems give large capacity on complex ores with clean separation. There is a Wilfley riffle to meet practically every conditon in the concentration of ores.

In one case a set of our new riffles on an an old Wilfley **increased the capacity five times.**

It is important to get the right riffles to meet your conditions. Our engineers will gladly cooperate with you.

Learn why the Calumet & Hecla Mining Co., Anaconda Copper Co. and other plants each have more than 500 Wilfleys.

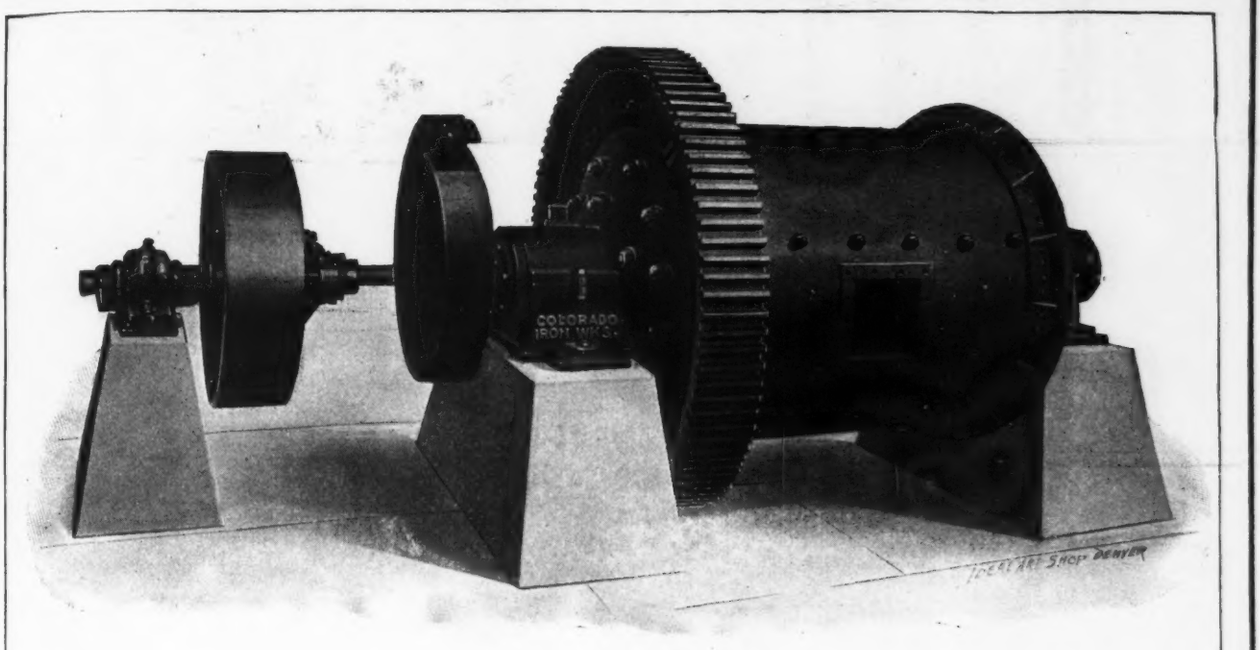


The Mine and Smelter Supply Company

A Service Station Within Reach of You

Denver Salt Lake City El Paso

New York Office: 42 Broadway



Central Discharge for Fine Grinding
Annular Discharge for Coarse Grinding

A convertible discharge—this feature is provided in all Colorado Ball Mills.

For flotation or wherever a fine product is needed the usual central discharge is used.

But in the

COLORADO
CONVERTIBLE DISCHARGE BALL MILL

Comparatively coarse products are given an annular discharge with gratings. This increases capacity; it minimizes slimes and results in improved table recovery.

Our bulletin "Grinding Machinery" is one you'll be glad to keep handy. Remember we make Rolls, Crushers, Stamps, Ball Mills, Tube Mills, Grinding Pans, and a full line of milling and smelting equipment.

The Bulletin helps you decide on which equipment is best to use for your work. Write for a copy.

Colorado Iron Works Co.
Denver, Colorado
309 Broadway, New York, N. Y.

"Well, there's one mine that will be ready for any emergency" says Phillie Gear

Have you anticipated the gear needs of your mine? Are you in a position to prevent possible tie-up by having on hand an ample stock of the gears you are likely to need?

As Phillie Gear says—"....there's one mine that will be ready for any emergency"—

It's the mine for which the blanks shown above are about to be converted into gears by Phillie Gear's men.

If your mine is not similarly prepared get Phillie Gear working for you quick—

Remembering that if the need is urgent he is ready to show you real speed in quality gear-making.

Catalog?

PHILADELPHIA GEAR WORKS

Vine and 12th Streets, Philadelphia, Pa.

Snowstorm Mining Company
Troy, Montana

15

of *our* tables separating *Lead* and *Zinc* from Primary Ore, also the *Lead* and *Zinc* in *Flotation Concentrates.*

The

Deister CONCENTRATOR Company

Manufacturers of DEISTER, OVERSTROM and DEISTER-OVERSTROM Tables in either Single or Double Deck types:

Main Office, Factory and Test Plant—Ft. Wayne, Ind.

Denver Office: 1718-1720 California St.

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A. B. C. 5TH EDITION
BEDFORD-McNEIL

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Your men's time is too valuable to be employed for work that can be done by machinery.

"LITTLE TUGGER" HOISTS

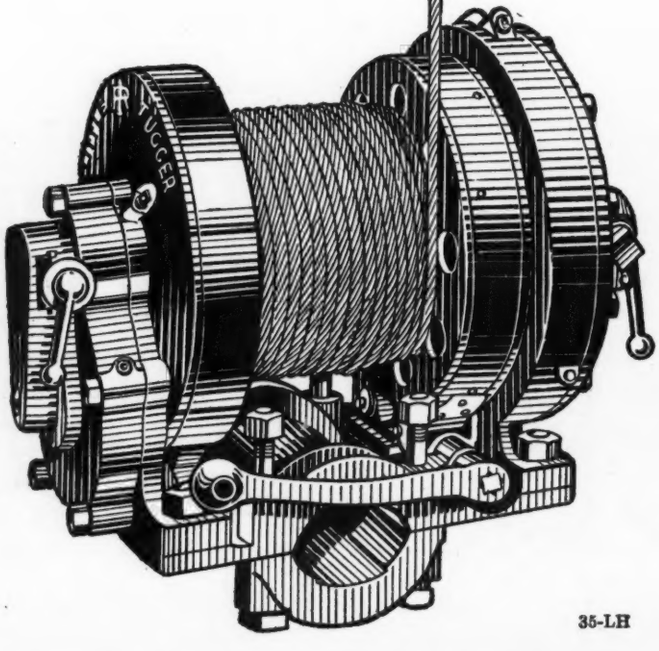
have replaced man-power in many mines for such work as hoisting drills, steels and supplies in shafts, winzes and raises, hauling in the stopes, pulling out timbers from old workings, handling cars on slight grades—and a hundred and one other jobs.

With the labor shortage growing more acute it is important that you conserve your man-power by concentrating it on productive work.

Let "Little Tugger" do the odd jobs. It will do them quicker, at less expense—and requires but one operator. There will be no need for the one man to call to others for assistance.

Bulletin 4233 tells the story.

Ask for a copy.



Ingersoll-Rand Company

11 Broadway, New York **165 Q. Victoria St., London**

OFFICES THE WORLD OVER

For Canada, Address CANADIAN INGERSOLL-RAND CO., Montreal

Air Compressors **Rock Drills** **Sharpeners**

35-LH

The Slogan of the Cameron—"Character: The Grandest Thing."

An Economical Low-Head Pump
Cameron Centrifugal

Mining men have found that the sure way to secure the utmost pumping economy for low-head service is with this "CAMERON" Centrifugal shown below.

It has been designed and built with the special aim to produce a combination of high-working value and low operating cost.

Every element in this pump is given the most careful attention during manufacture. There is no skimping of small details. Every part has the utmost strength.

It is the **Cameron Class "SV" Open Impeller type,** especially designed for low-head service. It is very simple, strong and rugged all through.

Bulletin No. 7152 gives the details. Shall we send it?

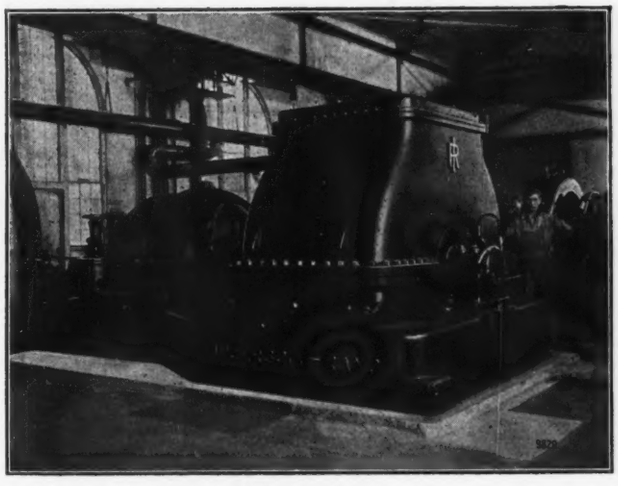
A. S. Cameron Steam Pump Works, 11 Broadway, New York
Offices the World Over

5-V

EVIDENCE OF SATISFACTION

In the results obtained by the use of Ingersoll-Rand Turbo Blowers is found in the fact that the companies which install them add similar I-R units as their requirements grow—for instance, the Tennessee Coal Iron and Railroad Co., the Anaconda Copper Mining Co., the Mark Manufacturing Co.

INGERSOLL-RAND TURBO BLOWERS



are built in capacities from 3000 to 60,000 cu.ft. per minute and pressures from 1 to 30 lb. per sq. in. for Blast Furnaces, Bessemer Converters, Foundry Cupolas, Copper Smelting, Lead and Zinc Smelting and similar low pressure requirements.

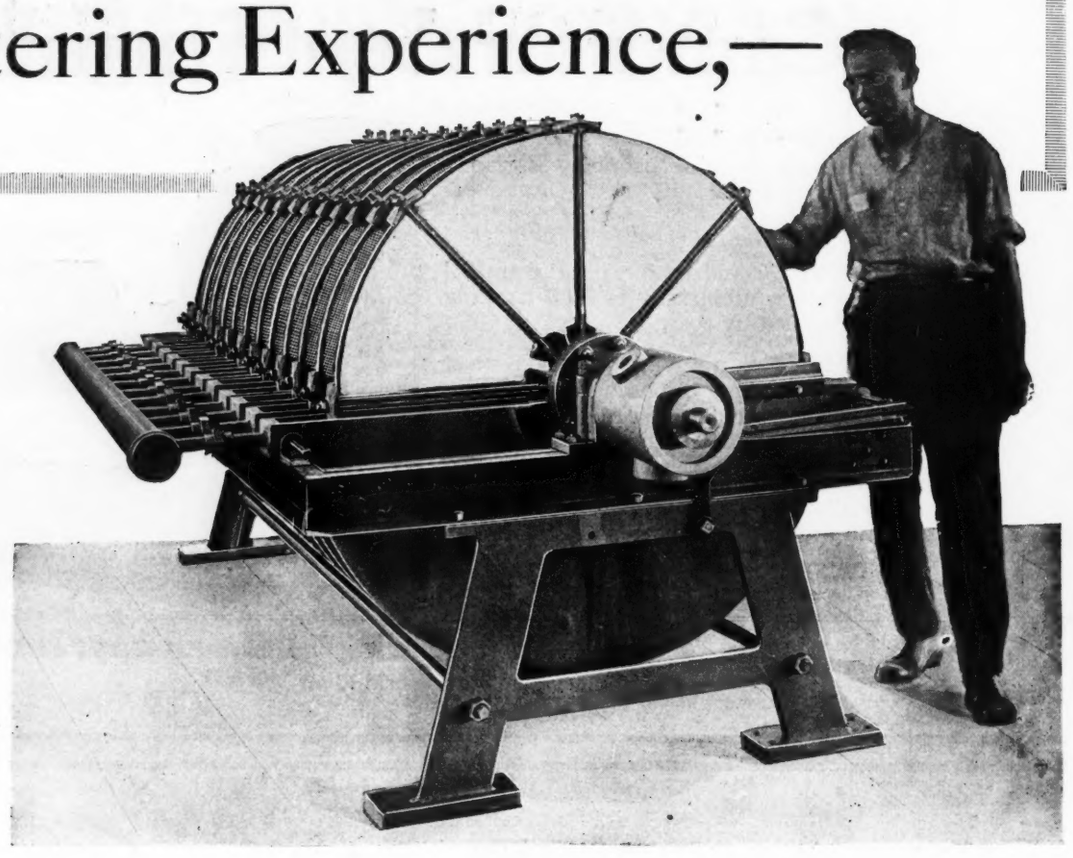
I-R Turbo Blowers may be had driven by live steam, mixed pressure or exhaust steam tnrbine or electric motor. They are automatically regulated—either constant volume or constant pressure.

Full Information on Request.

INGERSOLL-RAND COMPANY
NEW YORK **LONDON**

23-T

Out of an *Unequaled* Filtering Experience,—



the *combined* Kelly and Sweetland experience—an experience which extends back to the first days of modern filtration—an experience which has to its credit more successful installations than any other organization, has been developed

The American Continuous Filter

Advantages of which are:

¶ Disc arrangement permits installing over twice the filter area in same floor space necessary for any suction filter.

¶ Disc and separate pan permit increasing filter area by adding another shaft section with discs and extra pans.

¶ Any single leaf may be easily removed and recovered while in operation, thus eliminating shutdowns.

¶ It discharges a drier cake than any other vacuum filter.

¶ Erected and put into operation more quickly than any other suction filter.

Ask for Descriptive Catalog.

UNITED FILTERS
CORPORATION

Home Office: Felt Building, Salt Lake City, Utah
Eastern Office: 36 Flatbush Avenue Extension, Brooklyn, N. Y. **Chicago Office:** Peoples Gas Building, Chicago, Ill.
Export Trade Agents: Allied Sugar Machinery Corporation, 120 Broadway, New York City

"DREADNAUGHTS" DRIVE IN RECORD TIME

The Spiro Tunnel of the Silver King Consolidated Mining Co., Park City, Utah ,is being driven with "Dreadnaught" Drills. This 6 x 8 foot tunnel has been driven 4500 feet within the last year.

One of Ninety "Dreadnaughts" used by the Butte & Superior Copper Mining Co., Butte, Mont.

The superiority of the "Dreadnaught" is being continually demonstrated. It is a "one man" machine distinguished for ease of set up and operation, and though light enough to be used unmounted for down hole work, yet its rapid drilling power and ability to stand up under the heaviest service have established for it an unequaled reputation for efficiency.

Holes are not lost with the Dreadnaught; for when the steel begins to bind or runs into a slip, the drill can be cranked back while running under the full force of rotation without damage to the machine.

ROCK WAUGH DRILLS

Learn about Waugh efficiency in sharpening and shanking Steel—Write for Bulletin ES on the Waugh Model 8 Drill Sharpener.

THE Denver Rock Drill Manufacturing Co.

DENVER, COLO.

225 Rialto Bldg., San Francisco, Calif.
301 San Francisco Street, El Paso, Texas
105-106 Maynard Bldg., Seattle, Wash.
393 Calle Carabayo, Lima, Peru.
113 W. 2nd South Street, Salt Lake City, Utah
Houghton, Mich. Joplin, Mo.
34 Queen Street, Melbourne, Australia
30 Church Street, New York City
401 Title Insurance Bldg., Los Angeles, Cal.
51 W. Granite St., Butte, Mont.
Royal Chambers, Johannesburg, So. Africa

CANADIAN ROCK DRILL COMPANY, LTD., Selling Agents:
42 Scott St., Toronto, Ont. Cobalt, Ont. 614 Baker St., Nelson, B. C. 912 Pender St., Vancouver, B. C. E51

Hoist Accidents Rank Fourth In Mine Accident Causes—

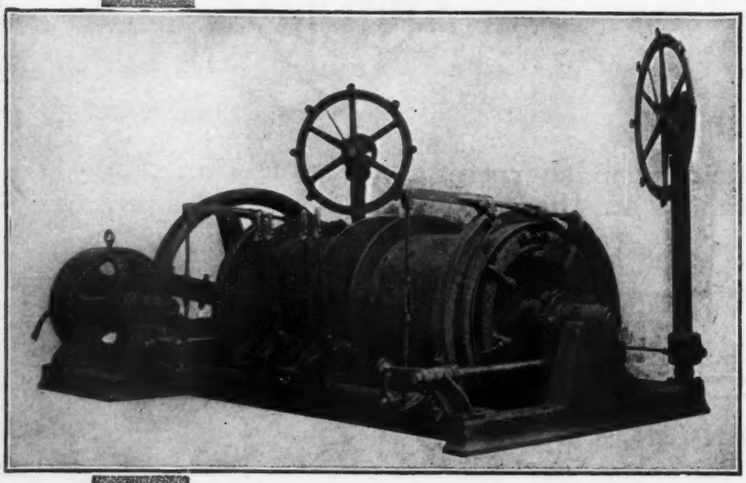
Statistics show that the causes of mine accidents in the United States rank, (1) Falls of rock; (2) Explosions; (3) Falls of Persons: (4) Hoist accidents.

In other words, of all mechanical equipment; hoists are the most prolific cause of accidents.

The first (3) causes are largely impossible of control. The fourth is possible of control. Choose the hoist which reduces possibility of hoist mishaps to a minimum.

Wellman-Seaver-Morgan

Now that compensation laws are becoming prevalent, it is absolutely necessary that hoists be chosen on a disregard of first cost—with an eye to **service** and **safety.**



Electric Hoist of Smuggler Leasing Co., Aspen, Colo.

The higher cost of WELLMAN-SEAVER-MORGAN Hoists is a necessary result of their greater cost of manufacture. The margin of difference in price represents better material, more careful design—ample safety devices which anticipate every contingency of peril.

Put your mine into the "safe" class by specifying WELLMAN-SEAVER-MORGAN for your hoisting service. Investigate.

The Wellman-Seaver-Morgan Company
Cleveland, Ohio, U. S. A.

1,000 FEET IN 4 HOURS

In four hours one man can install a 1,000 foot line of 16 inch

FLEXOID TUBING

Patented Jan. 2, 1917—Other Patents Pending.

Sprags are placed in the roof at fifteen foot intervals from which a wire is strung. Over the wire, special hooks furnished with the tubing, are attached and ***FLEXOID*** is suspended ready to deliver air.

Twenty minutes after shooting, the gases and fumes are cleared; the machine men "set up", the muckers start right in to work.

But get the complete facts—our new book, "Better Ventilation—Lower Production Costs" shows how you can increase your labor efficiency 50% and eliminate 75% of the time lost after blasting.

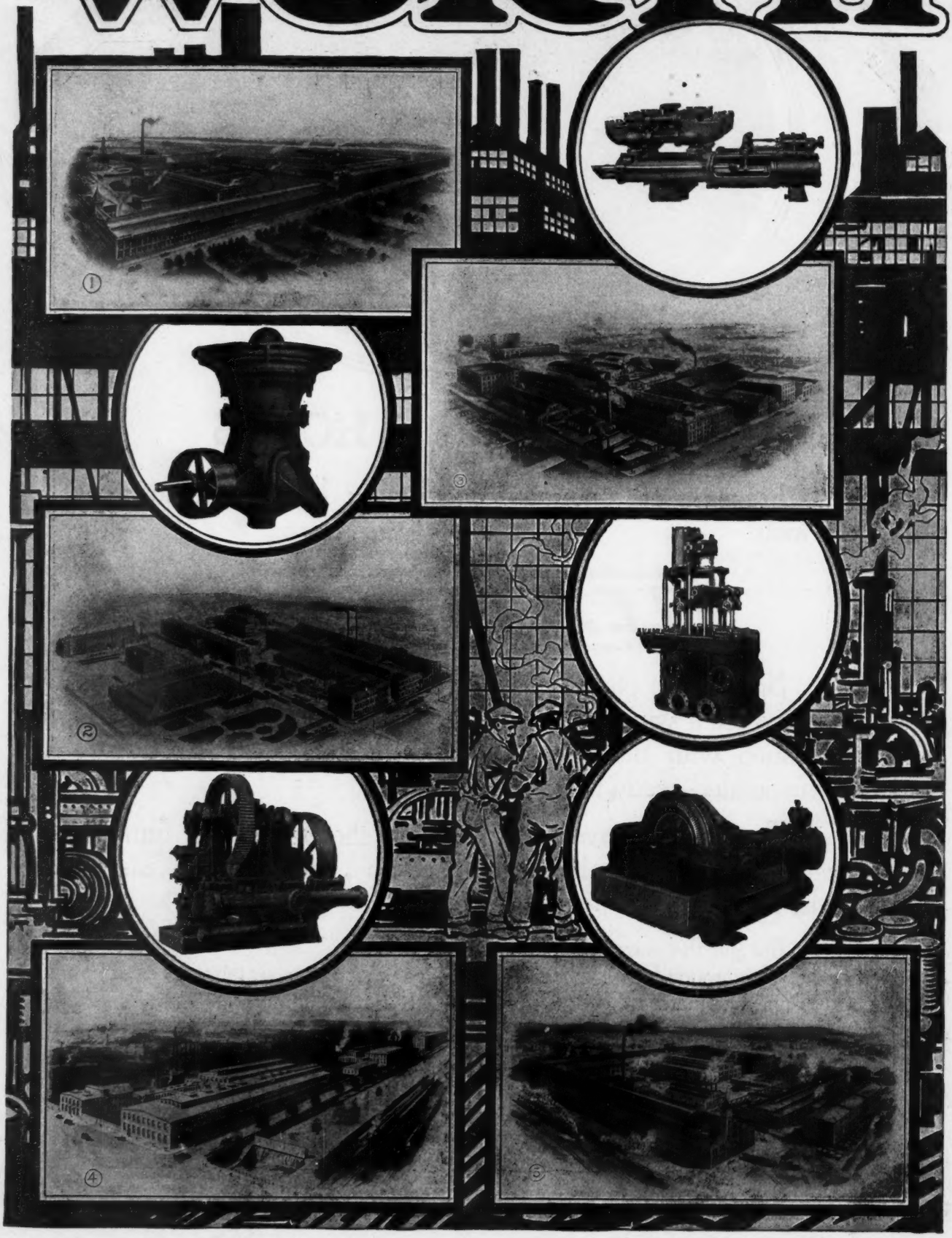
Write today for your copy—and our free trial offer.

BEMIS BRO. BAG CO.

Selling Agencies in Principal Cities and Mining Camps of the World.

4125 Poplar St. **Established 1858** **St. Louis, U. S. A.**

WORTH



INGTON

COMMANDING the vast facilities of the nine great works housed in the structures shown here, the Worthington Pump and Machinery Corporation possesses unquestioned leadership in its field.

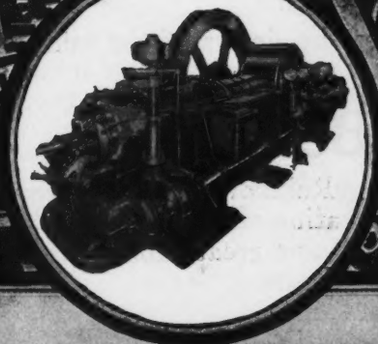
With plants of unequalled size, modern equipment highly efficient operation and skilled employes standing behind its products, the Worthington Pump and Machinery Corporation occupies a dominating position with respect to capacity for serving the requirements of America's industries.

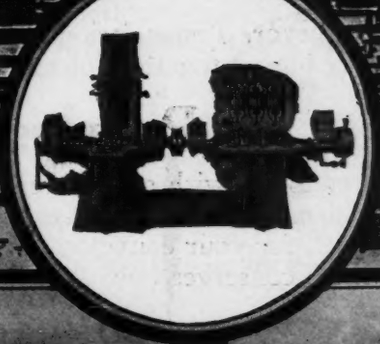
AIR COMPRESSORS **CONDENSERS**
OIL AND GAS ENGINES **PUMPS**
MINING, SMELTING AND REFINING MACHINERY

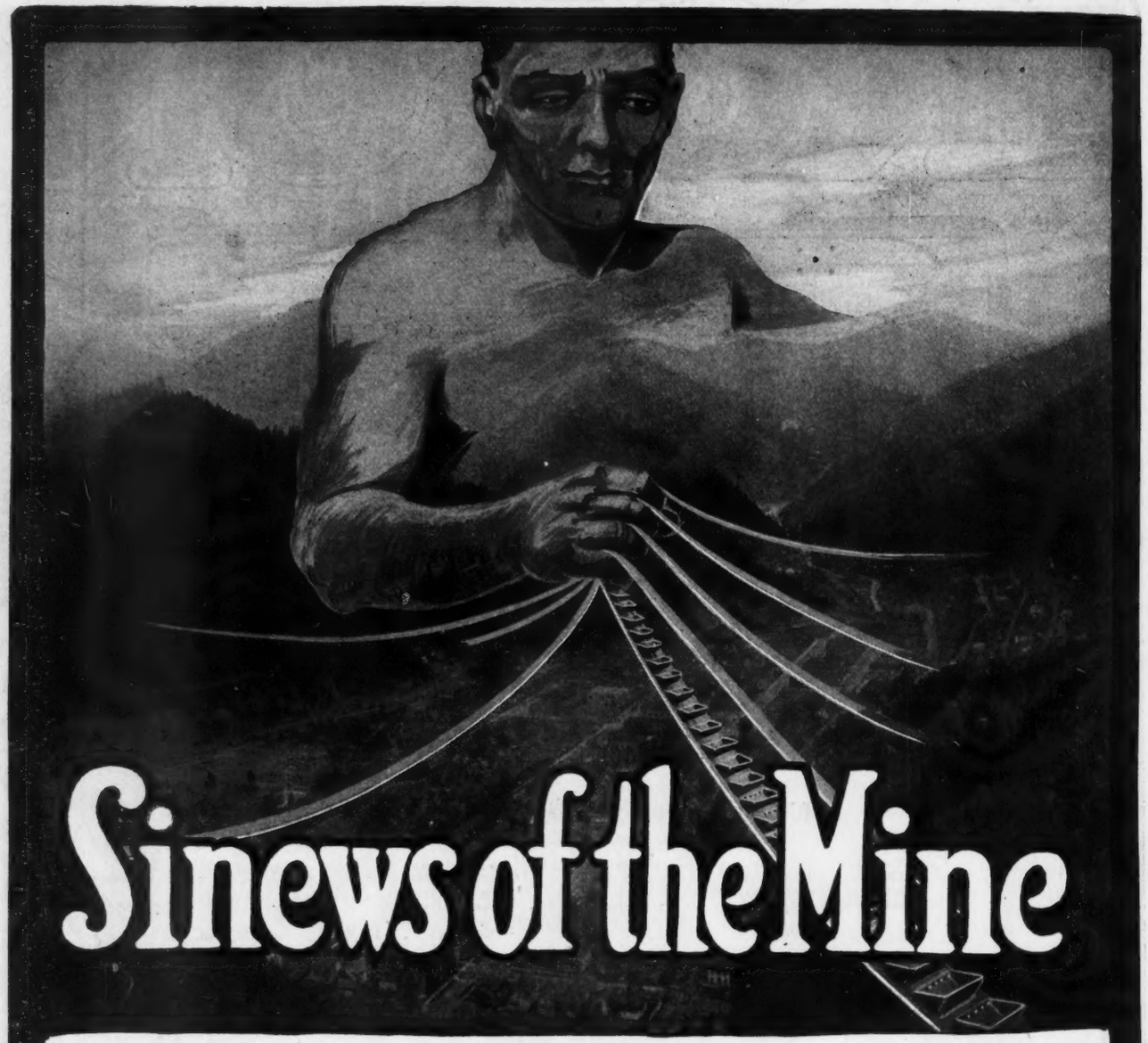
WORTHINGTON PUMP AND MACHINERY CORPORATION
115 Broadway, New York

Worthington Works,	Harrison, N. J.	Deane Works,	Holyoke, Mass.
Blake-Knowles Works,	E. Camb., Mass.	Laidlaw Works,	Elmwood Place, O.
Power & Mining Mchy. Wks.,	Cudahy, Wis.	Snow-Holly Works,	Buffalo, N. Y.
Ingeco Works,	Cudahy, Wis.	Jeanesville Works,	Hazleton, Pa.
Prescott Works, Cudahy, Wis.			

Branch Offices in all Principal Cities **I-53**







Sinews of the Mine

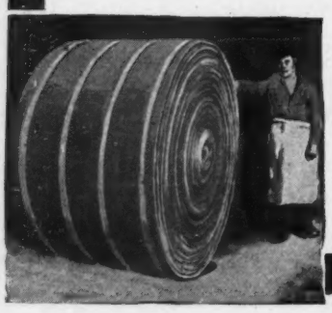
Conveyor, Transmission and Elevator Belts are the sinews of the mine—they bind it together into a composite whole.

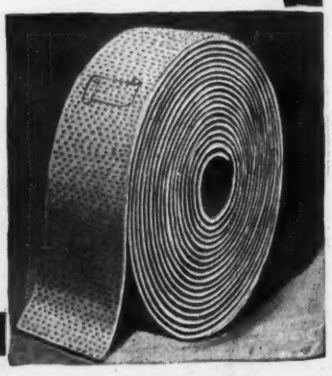
Peerless Rubber Belting

is endowed with giant strength and endurance. "Rainbow Belts" for your transmission drives, "Peerless 4661" for your elevating and "Peerless 4772-4771" for your conveying are all members of the same great rubber family which conserves power, reduces cost, increases production.

Whatever your belting problems in the mine, Peerless can help you.

Send for your copy of the Belting Catalog.

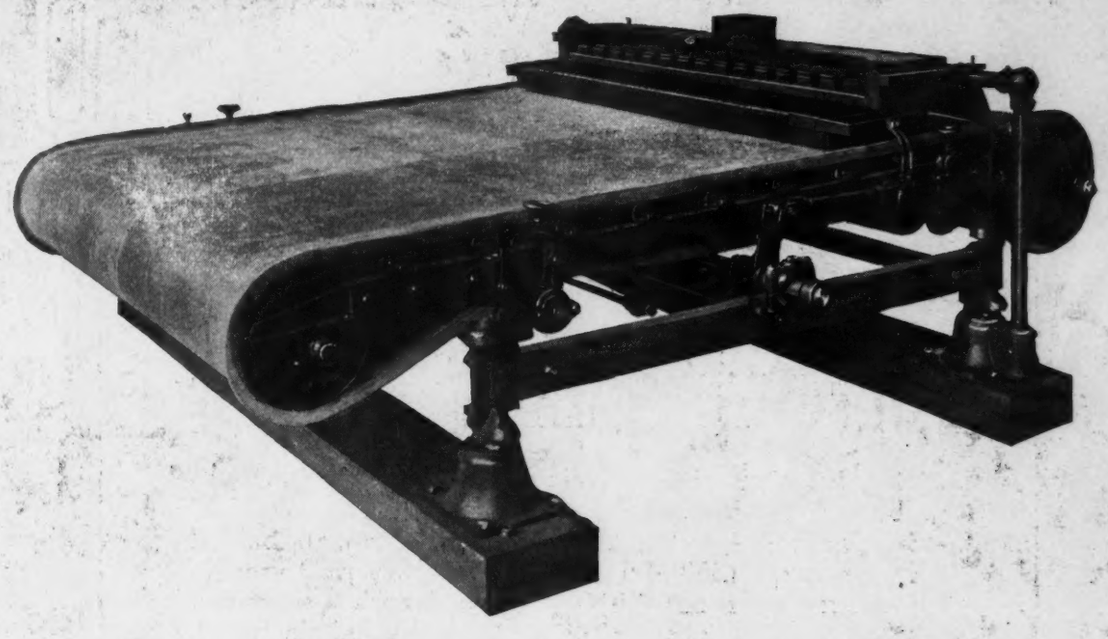




Peerless Rubber Mfg. Co.

31 Warren St., New York City

Branch Stores: Boston, Chicago, Minneapolis, Philadelphia.
Stocks carried in all large mining centres.



The 1918 Model, Simplified Senn Panning-Motion Concentrator

has been perfected and put on the market

It combines the superior qualities of our former models in **Large Capacity, High Recovery** and **Low Water Consumption** with a marked **Simplicity** of **Construction** and an ease of operation and adjustment that readily gives it first place as the highest development in gravity concentrating machines.

The main weight of the machine is entirely **Supported on Ball Bearings** which **require no lubrication** and **automatically take up wear.**

The **Smoothness of its Operation,** with its perfect circular "panning" motion, enables it to **settle the finest particles** of concentrate while keeping the **coarsest feed perfectly loose,** and prevents any disturbance of the concentrates after they are settled, until they are discharged into the concentrate box.

Its Large Capacity, with its **High Recovery,** enables the operator to handle the **entire tonnage** of his mill with **few machines,** even with the most difficult ores. One Senn handles the **same load as 3 to 6 vanners** of any other make, or the **same load of any feed as any "deck" machine. Its Recovery** in either case is **radically superior** to that of the machines it displaces, while the **floor space and water required are less.**

The Simplicity of its Construction enables us to offer it at a lower price than our former models, while maintaining the **highest quality of materials and workmanship throughout.**

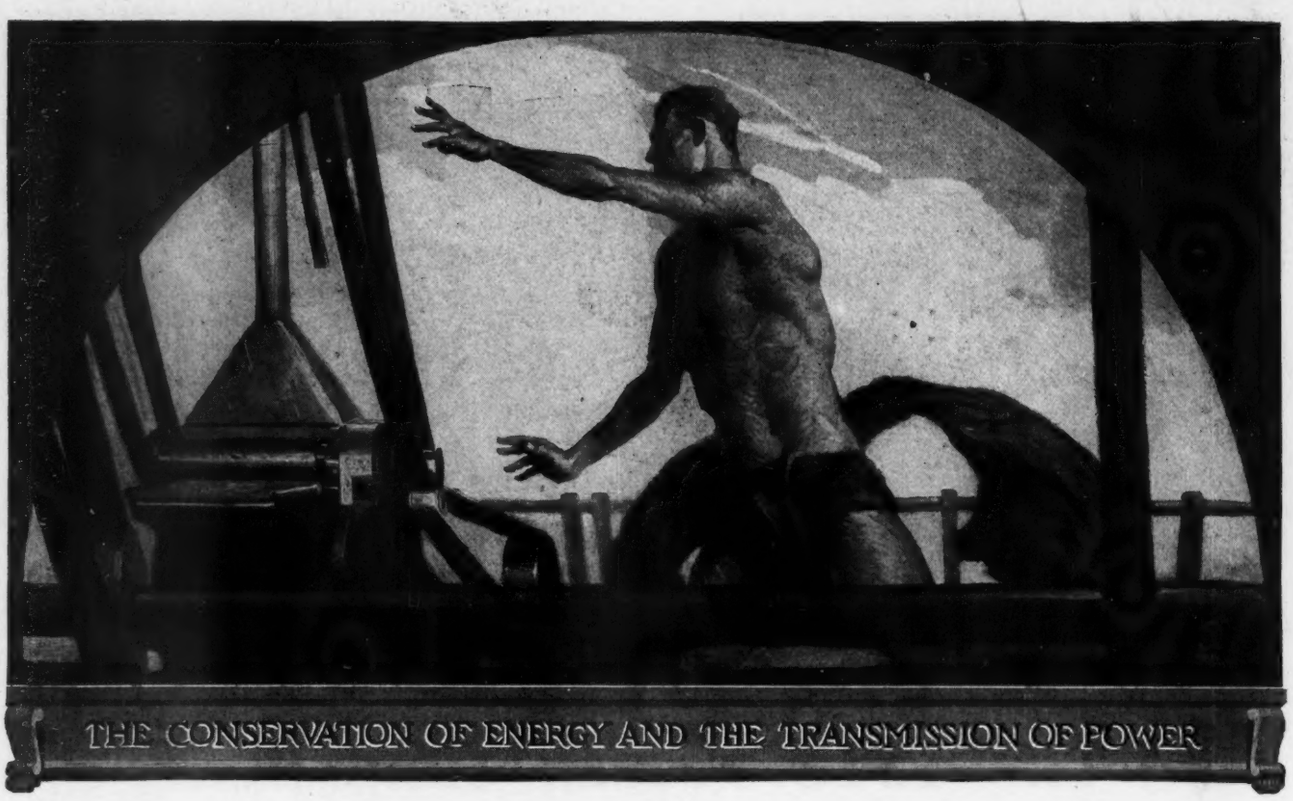
The superior work done by our Concentrators is acknowledged.

We now offer a simpler machine with all the former advantages included.

SENN CONCENTRATOR COMPANY

607 J, FIRST NATIONAL BANK BUILDING, SAN FRANCISCO, CAL., U. S. A.

Cor. Post and Montgomery Streets



Glide Belts For Small-Diameter Crowned Pulleys

The undue "stretch" found in ordinary belts driving small-diameter, high-speed crowned pulleys is a matter of common knowledge.

But the cause of this "stretch," and its wearing effect on the ordinary belt, is appreciated only by specially trained engineers.

On every crowned pulley the part of the belt running over the middle must either stretch or go faster than the parts over the sides of the pulley face.

For the pulley circumference in the middle is greater than the circumference on the sides.

The consequent stretching strains are so great that they materially shorten the life of leather, of tightly woven fabric, of stitched, and of many other types of belt construction.

Glide Belts are especially constructed to reduce to a minimum the effect of these strains, inseparable from the use of crowned pulleys.

Their special-weave duck and the superior compound impregnating their every fibre, give them exceptional pliability coupled with notable compactness and strength.

Many Glide Belts originally installed as "proof" belts have secured orders for large installations because their construction permits exceptionally gratifying service records on crowned pulleys.

Their price is frequently less than that of some type of belting and higher than that of others.

But their true cost—the continuous satisfactory service per dollar paid for them—is uniformly lower.

Transmission and conveyor belting—steam, air and water hose—Goodyearite Packing.

The Goodyear Tire & Rubber Co., Akron, Ohio

GLIDE TRANSMISSION BELTS
GOODYEAR

Goodyearite Resists Oil

Not all asbestos sheet packing will adequately resist the rotting action of oil.

In too many varieties the amount of rubber binder used is so great that the product is not sufficiently better, when constantly subjected to oil, than is high grade rubber packing.

Such inferior asbestos sheet packings may serve a useful purpose as gaskets for oil-free situations.

But Goodyearite will resist the rotting action of oil.

It is made of the longest fibred rock-asbestos obtainable.

This kind of asbestos requires an almost negligible amount of binder.

In consequence it is the best asbestos sheet packing made; not only because it resists oil but also because it resists the disintegrating effects of superheated and saturated steam.

Its long fibre asbestos and superior construction are proof against the most exacting temperatures now found in industrial practice.

Its compacted fibres do not admit moisture and so the gaskets made of it are as satisfyingly proof against the swelling due to saturated steam as they are against superheat and oil.

If you have never tried Goodyearite we will gladly send you without charge enough to permit you to prove its merits beyond question.

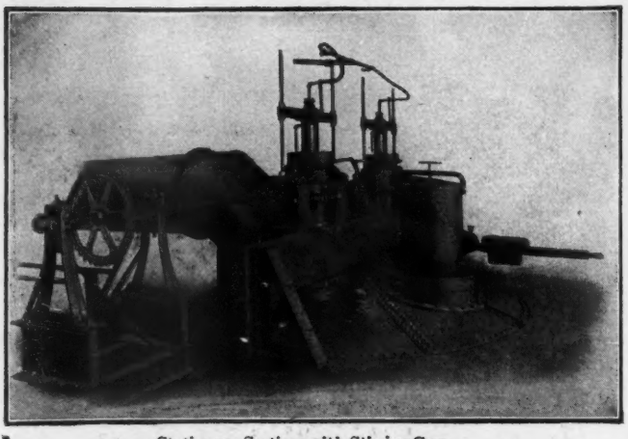
The Goodyear Tire & Rubber Co., Akron, Ohio

· PACKING · BELTING · HOSE · VALVES ·

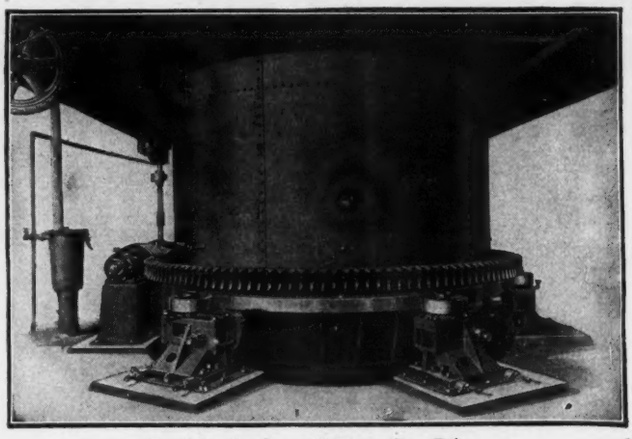
GOODYEAR

REDUCED OPERATING COSTS

will follow the use of these producers in connection with your smelting and roasting furnaces.



Stationary Section, with Stirring Gear.



Revolving Section, with Worm Gear Drive.

"The Wood Mechanically Operated Gas Producers"

excel in economy and quality of the gas, and effects a large saving in labor, as no hand poking is necessary even under continuous maximum production. One producer gasifies 3,330 lbs. of coal per hour, and the gas contains from 26 to 28% CO.

R. D. WOOD & COMPANY, PHILADELPHIA, PENNA.

Makers of Centrifugal Pumps, Cast Iron Pipe, Fittings, Valves and Special Castings.

Butchart Concentrating Tables
Are the Best Money Will Build

Fully enclosed, self-oiling drive mechanism. Carefully constructed sliding bearings, running in oil Best tilting device ever made. No wood used except in deck. Latest and best feed and water distributors. Butchart riffling is the most efficient yet produced. Every improvement embodied in Model No. 3.

Originator of
Deflected riffling.
Self-oiling drive.
Sliding bearings.
All metal mounting.

Sold on Merit, not on Price Competition.

W. A. Butchart, 605-607 Mercantile Building, Denver, Colo.

The New Herreshoff Temperature Controlled and Air-Cooled Furnace

for the

NEW YEAR

Start the New Year right in one important particular, the roasting of ores, and see how much better you feel in a few months.

Better ore roasting results and bigger profits are the possibilities.

This type of furnace insures scientific and economical roasting.

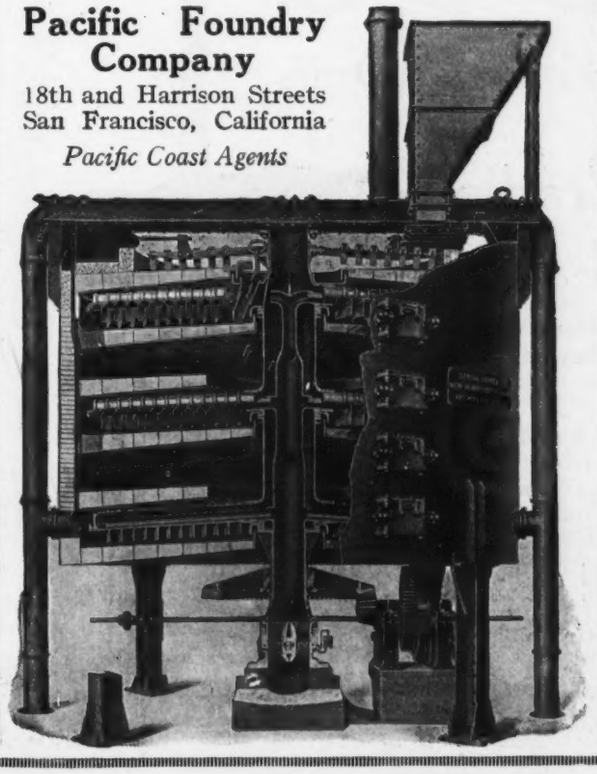
It makes it possible to attain and maintain just the right temperature at each step of the roasting, without at any time causing fusion.

In the New Herreshoff Temperature-Controlled and Air-Cooled Furnace you secure three important advantages: Perfect roasting, increased capacity per square foot of hearth area, and low repair costs.

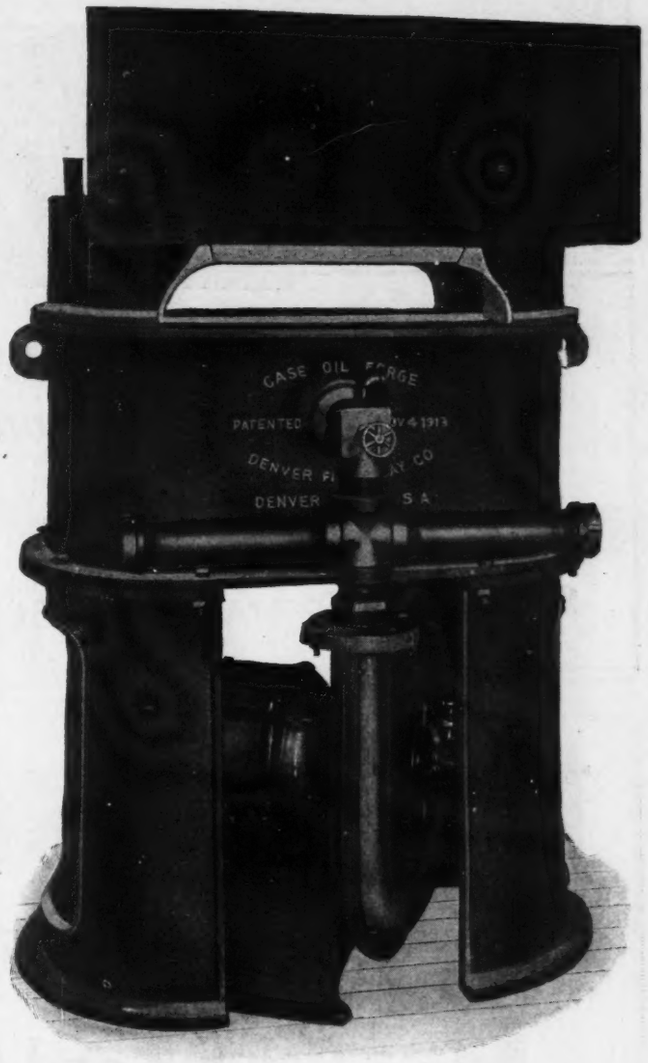
Did you ever write for a copy of our interesting Bulletin?

GENERAL CHEMICAL COMPANY
Herreshoff Furnace Department
25 Broad Street, New York, N. Y.

Pacific Foundry Company
18th and Harrison Streets
San Francisco, California
Pacific Coast Agents



Case Oil-Burning Low Pressure Forge



This Forge Cuts the Cost at Every Angle in Heating Drill Steel

NO BURNING or SCALING

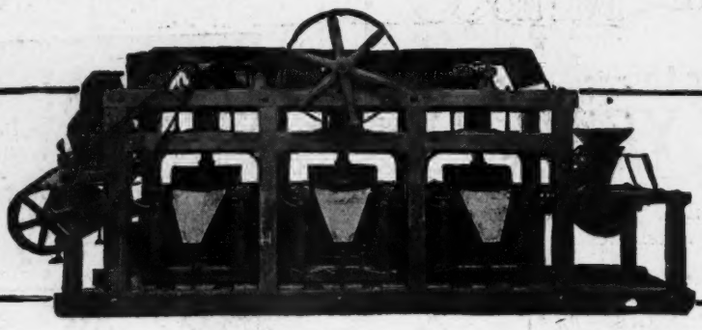
LESS LABOR than with any other method.
IT'S RAPID—keeps *two* machine sharpeners busy
UNDERGROUND it also gets the money.

Write us for proof of how One Case Oil Forge is saving a great mine $12.50 per day.

DENVER FIRE CLAY CO.
Denver, Colo., U. S. A.

Dings Magnetic Separators

High Intensity ***Rheostatic Control***



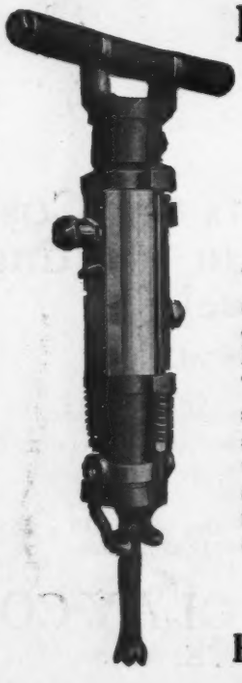
Segregates the various constituents of Ore in one continuous operation

We provide machines of high intensity for the separation of as many magnetic constituents as desired in a single operation. The regulation of intensity is easily accomplished by means of controlling rheostats which come with the machine.

Magnetic separation is not only practicable, but highly economical in connection with a wide range of metals. Send samples of your ore for preliminary test and let us demonstrate to you just what a Dings Magnetic Separator will do for you.

DINGS MAGNETIC SEPARATOR COMPANY
673 Smith St., MILWAUKEE, WIS.

HARDSOCG



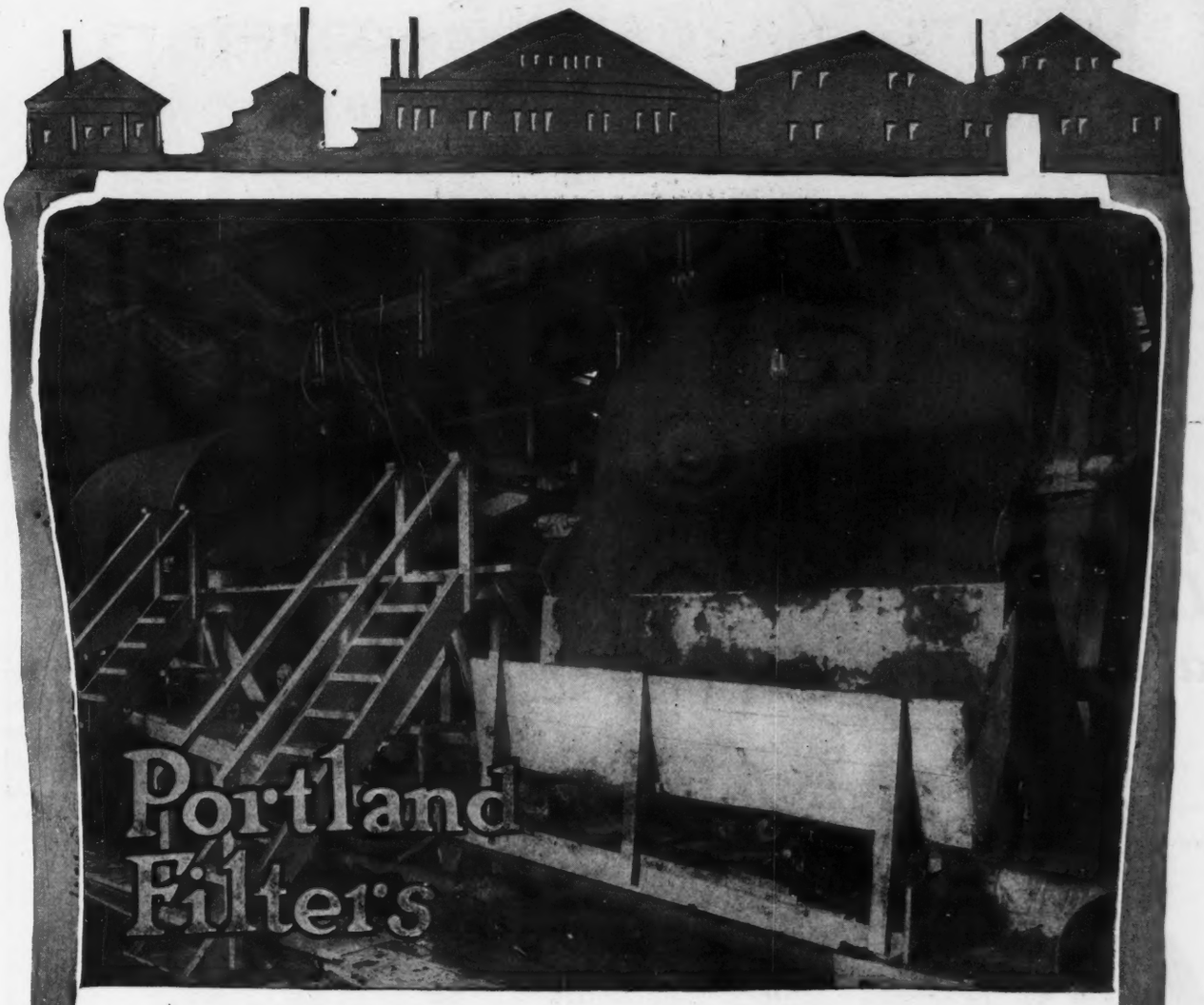
No. 66 and No. 67 Hammer Drills with Column and Cradle Mounting

The No. 66 and No. 67 Hardsocg Hammer Drills are well known for their lightness, ruggedness and economical operation. They have been setting hard rock records for years.

The Column and Cradle Mounting for them, here shown, adds greatly to their natural efficiency. The screw feed relieves the strain on the operator and when the column, arm and clamps and cradle and slide are used the machine can be turned under arm for bottom holes without getting the drill out of alignment.

Full particulars on request.

HARDSOCG WONDER DRILL CO., Ottumwa, Iowa



Nine Points of Superiority

Forms a thin cake, easily removed, which is easily washed, without channeling. Little solution and wash water are required.

Cake is loaded evenly and dislodged uniformly, without clinging more to one part than another.

Great capacity per unit of filtering area.

Reduced wear on cloths.

Many patented features. Does not infringe any other filtration patents.

Dry cake makes handling easier, saves freight, prevents waste in shipment.

Little power and no manual labor required.

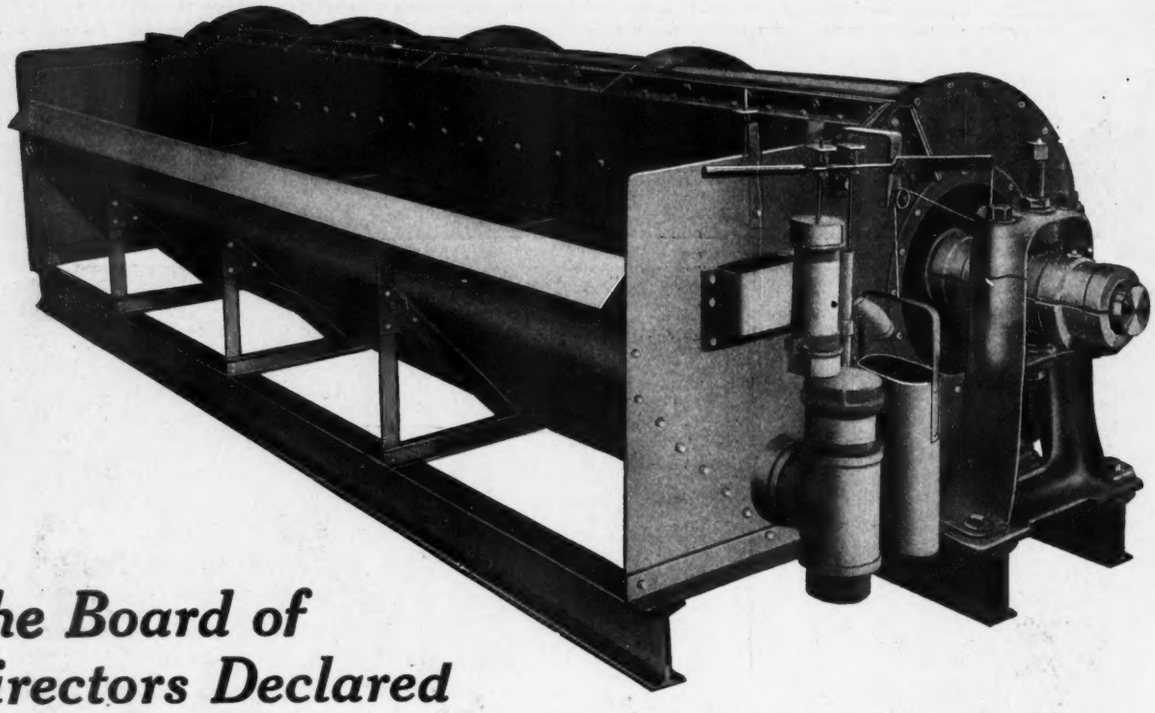
Low first cost.

Shipped as a complete machine, easily set up.

COLORADO IRON WORKS COMPANY

New York Office
309 BROADWAY

Main Office and Works
DENVER, COLO.



The Board of Directors Declared a Dividend of—

That's the only interest the shareholders have in your property. The amount per cent. of the dividend. And when you get right down to hard facts, the amount of the dividend, or the lack of it, determines whether a new staff of officials takes over the running of the property or the present one gets a bonus.

The K & K Flotation Machine

will insure two things: The economic recovery of the mineral, at the very lowest cost for recovery.

One Operator Reports NO LOST Time.

Flotation Feed 1.5% Copper
Flotation concentrates 23.5% Copper
Flotation tails 0.06% Copper.

Capacity of machine 100 tons per 24 hours (dry feed) and able to handle more. Ore-Chalcopyrite with lots of Biotite in the gangue.

Another Operator sends a repeat order for treating a lead carbonate tailings product where another type flotation machine failed to give an economical extraction.

Capacity 80 to 150 tons per day
Power required, 8 H.P. or less
Size of machine, 14 x 4 ft.
No pre-agitation required
No blower or air compressor required

Send for Bulletins and learn all about how the K & K will actually increase the dividends payable.

Southwestern Engineering Co.

INCORPORATED

106 W. 3rd St., Los Angeles, Cal.

Power—Stamina—Economy
—in-built qualities in the 5-ton FEDERAL

The Lake Sand and Gravel Co., one of the largest of its kind in Detroit, needs a *big* truck for its *big* jobs.

A truck not only big in size, but also one big in performance and dependability. In the FEDERAL 5-ton model shown above, they get the right relation between truck and job—100% service at maximum economy.

In an average day's work at sand haulage, this powerful FEDERAL made 7 round trips of 9 miles each—hauled 35 tons of sand and gravel *at a total operating cost of 17c per ton-mile.*

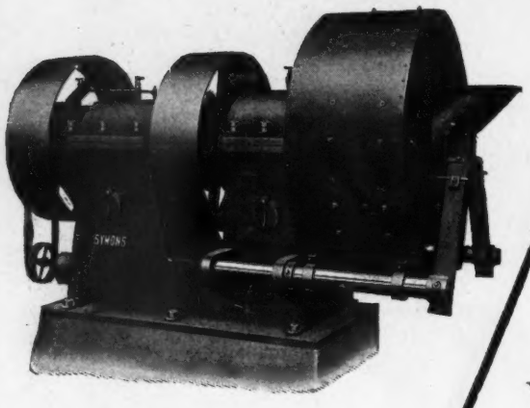
But one of the many evidences of the greater service you can expect from FEDERALS, this instance helps to prove again the three big FEDERAL features: Power—Stamina—Economy.

We'll be glad to mail you "Federal Traffic News" if you'll but make the request.

FEDERAL MOTOR TRUCK COMPANY

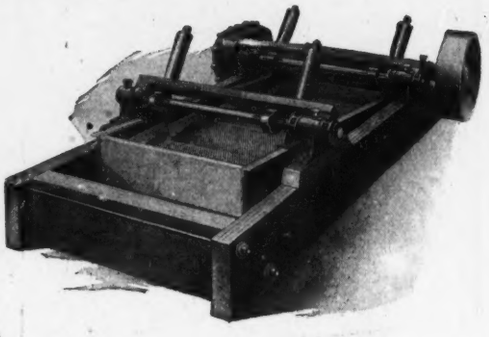
1500 Federal St., Detroit, Mich.

SYMONS

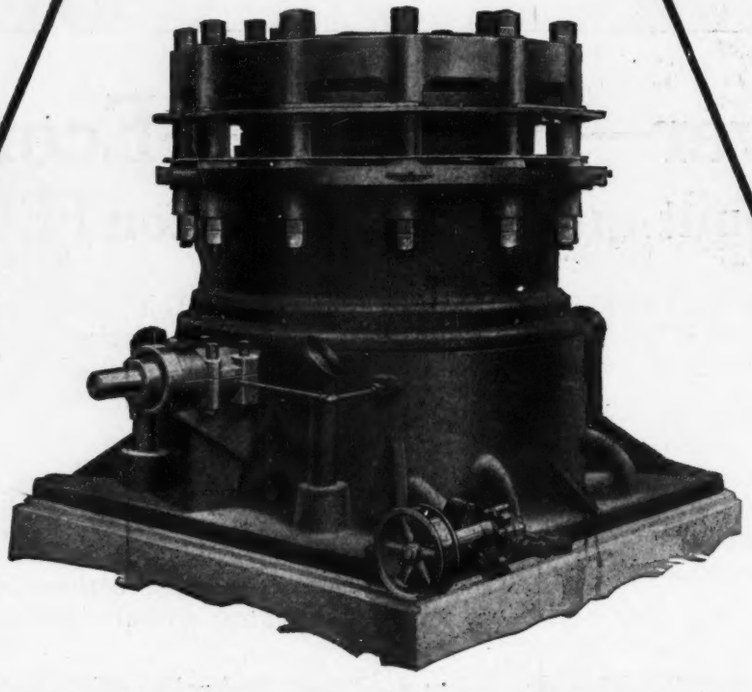


HORIZONTAL DISC CRUSHER

VERTICAL DISC CRUSHER



PULSATING SCREEN



Manufactured and Sold Only by

CHALMERS & WILLIAMS

Salt Lake Office: Dooley Block

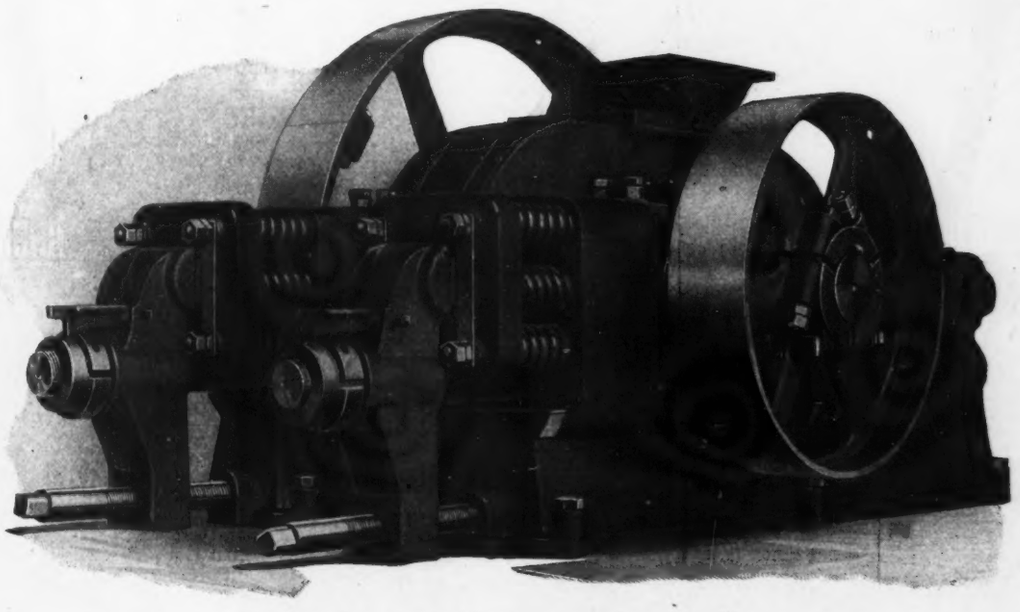
CHICAGO HEIGHTS, ILL.

New York Office: Equitable Bldg.

Ore Crushing by Rolls

In the treatment of certain ores—especially of low grade character where high cost of treatment would be prohibitive, and where uniform product and capacity are required—crushing rolls are usually installed.

We manufacture crushing rolls of several types—the spring pressure ranging from 4500 to 20,000 pounds per lineal inch of face according to size and type.



Style "XX"—Straight Line Roll.

The "XX" rolls are the most recent design, built for heavy spring pressure exerted in a straight line through the center of the roll thereby reducing the working stresses in the frame.

For further particulars ask for Bulletin No. 1811.

Allis-Chalmers Manufacturing Company

Mining Machinery Dept.—Milwaukee, Wis.

Sales Offices in Principal Cities

BARSTEEL

Combination Storage-Battery-Trolley Locomotive

The Mine Locomotive here illustrated is a Combination Storage-Battery-Trolley Locomotive.

The Storage Battery feature increases its radius of action, so that it can go any place in a mine that a track can be laid—independent of roof conditions.

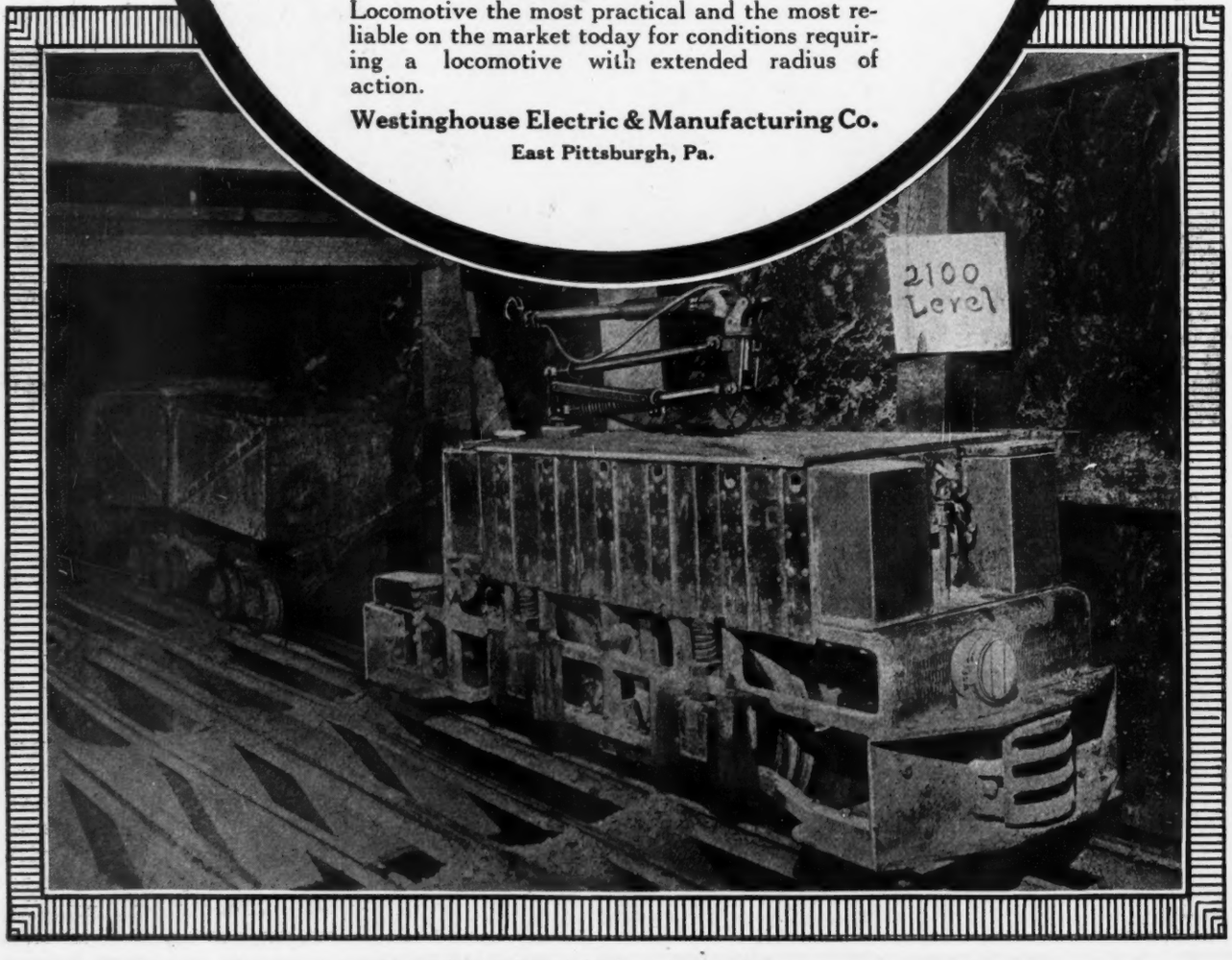
A further advantage is that the batteries may be recharged from the trolley during part of its operation.

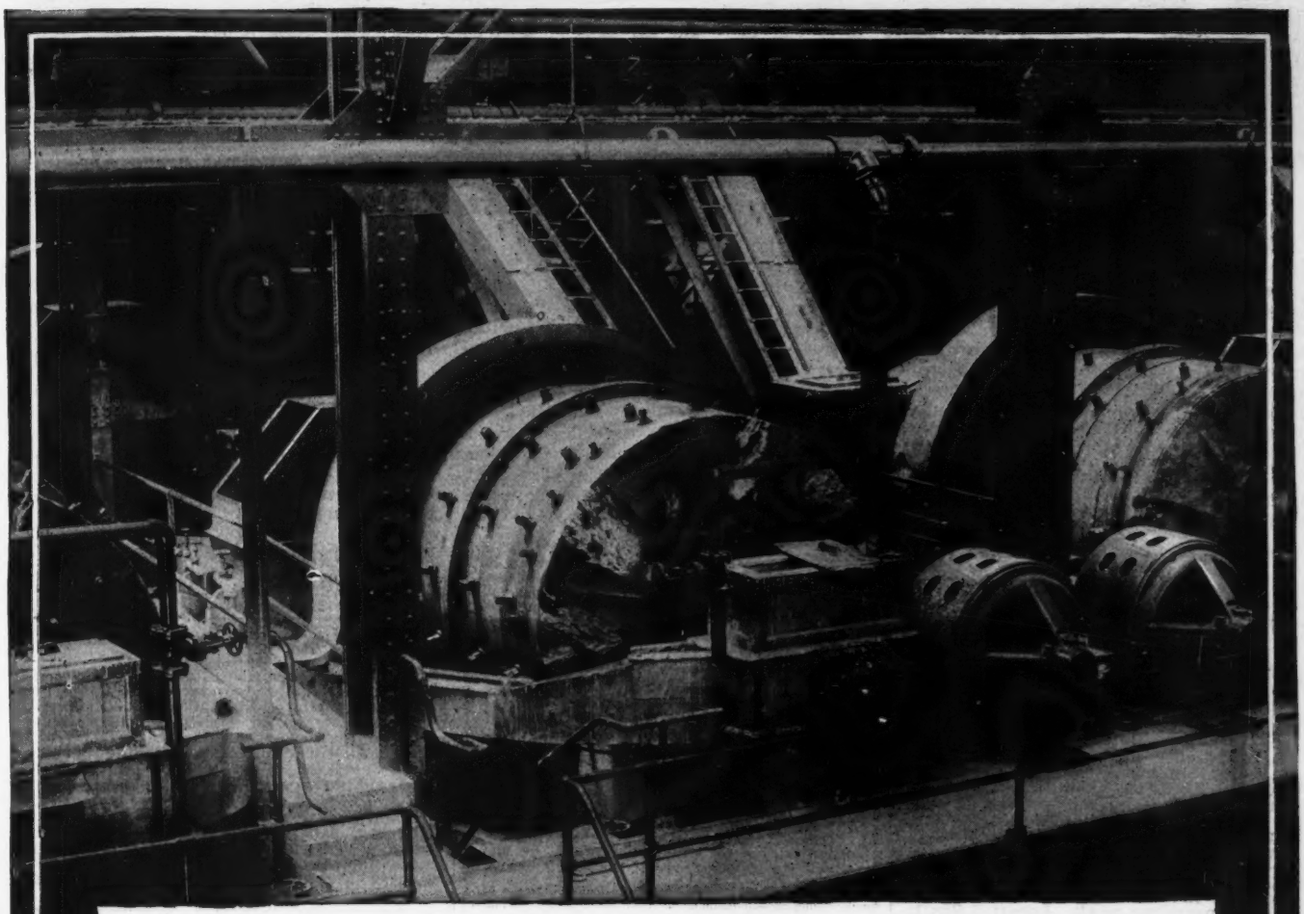
This Combination Locomotive has also the well-known BARSTEEL frame. This frame far exceeds the enclosed plate type in strength; and the open construction makes inspection, oiling and cleaning an easy matter.

All these advantages combine to make this Locomotive the most practical and the most reliable on the market today for conditions requiring a locomotive with extended radius of action.

Westinghouse Electric & Manufacturing Co.

East Pittsburgh, Pa.





Large Ball Mill Plant

Driven by G-E Motors

This notable installation of forty-eight electrically-driven Marcy Mills at the Inspiration Consolidated Copper Company, Miami, Arizona, must operate 24 hours a day for long periods.

For this, one of the largest installations of its kind in the world, G-E 225 H.P. induction motors were selected. These motors have high efficiency—so important for long period operation—and ample starting torque.

Practically standard construction was selected for these motors, and the selection has been justified during the last two years by an operating record which has been successful in every respect and the basis for large repeat orders.

Hundreds of grinding mills are driven by G-E motors. Among those using these motors are the Calumet and Hecla Mining Company, the Anaconda Copper Mining Company and others equally well known.

General Electric Company

General Offices: Schenectady, N. Y.

ADDRESS NEAREST CITY

Atlanta, Ga.	Columbus, Ohio	*Houston, Tex.	Los Angeles, Cal	New Haven, Conn.	Rochester, N. Y.
Baltimore, Md.	*Dallas, Tex.	Indianapolis, Ind.	Louisville, Ky.	New Orleans, La.	St. Louis, Mo.
Birmingham, Ala.	Dayton, Ohio	Jacksonville, Fla.	Memphis, Tenn.	New York, N. Y.	Salt Lake City, Utah
Boston, Mass.	Denver, Colo.	Joplin, Mo.	Milwaukee, Wis.	Niagara Falls, N. Y.	San Francisco, Cal.
Buffalo, N. Y.	†Detroit, Mich.	Kansas City, Mo.	Minneapolis, Minn.	*Oklahoma City, Okla.	Schenectady, N. Y.
Butte, Mont.	Des Moines, Iowa	Knoxville, Tenn.	Nashville, Tenn.	Omaha, Neb.	Seattle, Wash.
Charleston, W. Va.	Duluth, Minn.			Philadelphia, Pa.	Spokane, Wash.
Charlotte, N. C.	Elmira, N. Y.			Pittsburgh, Pa.	Springfield, Mass.
Chattanooga, Tenn.	Erie, Pa.			Portland, Ore.	Syracuse, N. Y.
Chicago, Ill.	*El Paso, Tex.			Providence, R. I.	Toledo, Ohio
Cincinnati, Ohio	Fort Wayne, Ind.			Richmond, Va.	Washington, D. C.
Cleveland, Ohio	Hartford, Conn.				Youngstown, Ohio

*Southwest General Electric Company †General Electric Company of Michigan
For Canadian Business refer to Canadian General Electric Company, Ltd., Toronto, Ont.
General Foreign Sales Offices, Schenectady, N. Y.: 30 Church St., New York City: 83 Cannon St., London, E. C., England. 7473

SEARCHLIGHT SECTION

Employment Department

Get your Wants into the Searchlight

ADVERTISING RATES

Under **"Positions Wanted,"** including Salesmen looking for new connections, Evening Work Wanted, etc., undisplayed advertisements cost **3 cents a word,** minimum charge 50 cents an insertion, **payable in advance:** less 10% if one payment is made in advance for four continuous insertions.

Under **"Positions Vacant,"** including Agents and Agencies Wanted, Representatives Wanted, Salesmen Wanted, Partners Wanted, Business Opportunities, Employment Agencies, and Miscellaneous For Sale, For Rent and Want ads.; also Auction Notices, Receivers' Sales, Machinery and Plants For Sale or Wanted, undisplayed advertisements set solid in one paragraph, cost **5 cents a word,** minimum charge $1.50 an insertion.

If replies are in care of any of our offices (New York, Philadelphia, Cleveland, Chicago or San Francisco) allow five words for the address.

Machinery advertisements (undisplayed) set with a paragraph for each item, or tabulated, 30 cents a line, minimum 5 lines. Set in display space:

1 inch	$3.00 an inch
4 inches	2.00 an inch
8 inches	2.80 an inch
15 inches	2.70 an inch

Rates for larger space furnished on request.

All advertisements for bids (**Proposals**) $3.60 an inch.

IMPORTANT—In replying to advertisements, do NOT enclose original testimonials, or anything that you may want returned. State your qualifications in as concise and neat a manner as you can and enclose COPIES of testimonials. In machinery ads, use a local name or address if possible so that readers can wire direct and get quick replies.

POSITIONS VACANT

MECHANICAL draftsman wanted for mining corporation in New York State. Experience necessary. P1000—Eng. & Min. Journal.

FOREMAN open pit mine, capable superintending mining operation and steam shovel. Location, Southwest Virginia, single man, draft exempt preferred; must be a labor handler. State salary and experience. Mining Department, Box 16, Narrows, Va.

CHEMIST to sample and run determinations for manganese, iron and to assist in the prospecting work. Location Southwest Virginia; state qualifications and salary. Chemist, Box 16, Narrows, Va.

CIVIL SERVICE

ASSOCIATE physicist, salary, $2000-$2400.

ASSISTANT physicist, salary, $1400-$1800. Must be qualified in physical metallurgy. Applications received at any time. Civil Service Commission, Washington, D. C.

EMPLOYMENT AGENCIES

CORRESPONDENCE SERVICE

TEMPORARY free registration—Applications accepted at present without registration charge from graduates mining, metallurgy, available $150 or lower. Desirable positions secured promptly. Business Men's Clearing House, Denver, Colo.

THE undersigned provides a confidential service designed to locate openings, through correspondence, for men earning not less than $2500 and up to $25,000; all lines. Not an employment agency, but a constructive, initiative service, covering individual negotiations. Established 1910. Complete privacy assured; present connections in no way jeopardized. Send name and address only for explanatory details. R. W. Bixby, W1 Niagara Square, Buffalo, N. Y.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad. and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
1570 Old Colony Bldg., Chicago.
657 Leader-News Bldg., Cleveland.
935 Real Estate Trust Bldg., Phila.
501 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

EMPLOYMENT AGENCIES

Interstate Positions

Copper Chemist, Nevada, $150; E. M. surveyor, New Mexico, $150; surveyor assayer, Washington, $125; mine shift boss, Colorado, $175; four flotation shift bosses, Colorado, $150 to $175; concentrator mill foreman, $150. Write or wire us, stating experience and age. Interstate Co., Kittredge Bldg., Denver, Colo., U.S.A.

POSITIONS WANTED

SMELTER office manager; ten years' experience covering metallurgical and general accounting, cost analysis, ore buying, etc. PW863—Eng. & Min. Journal, Chicago.

MANAGER, assistant manager or general superintendent, executive and business ability, together with the technical and practical efficiently applied; graduate Columbia; 20 years' rounded experience; New York interview if desired. PW809—Eng. & Min. Journal.

DRAFTSMAN, 10 years' experience designing machinery, jigs, tools, good working knowledge of chemistry, at present supervising manufacturing plant, desires to connect with mining concern who can offer permanent position with advancement. PW904—Eng. & Min. Journal.

OPEN to engagement as manager or superintendent; graduate mining engineer of large experience in the details of mine development and operation; general milling, cyanide treatment and concentration; mechanical equipment; successful in handling labor and in the general business management of a mining property. PW902—Eng. & Min. Journal.

OPEN on Jan. 1 for position as manager, consulting engineer or for special work with reliable mining company; have had wide and successful experience in these positions including the design and operation of large mining and milling plants in the United States and Mexico; only a position whose importance warrants the payment of good salary will be accepted. PW900—Eng. & Min. Journal.

POSITIONS WANTED

LEAD and copper metallurgist of 20 years' experience in lead and copper blast furnace smelting with thorough experience in American and Latin-American practice open for permanent position. PW911 Eng. & Min. Journal, San Francisco.

GEOLOGIST and engineer; member state geological survey; technical education; practical work underground and opencut mining, construction, metallurgy of gold and silver, examination and sampling of ore deposits, surveying, laboratory, statistics and office. PW901—Eng. & Min. Journal.

POSITION as manager or superintendent; technical; 11 years' experience various ores and properties; highest references from present employers. PW910—Eng. & Min. Journal, San Francisco.

EXECUTIVE position as manager or otherwise wanted by American, 30, single; speak, write Spanish fluently; experienced mine, smelter, mill accounting and systematizing; best references. PW903—Eng. & Min. Journal.

Cooks Wanted

for the Mining Regiment

First-class cooks, experienced in cooking for a large number of men, wanted for service with the 27th Regiment of Engineers, the mining regiment now being formed at Camp Meade, Maryland, for service in France. There will be six companies in this regiment and one or more cooks are needed for each company. Application should be made to the nearest recruiting station.

SEARCHLIGHT SECTION

Employment Department

POSITIONS WANTED

MINING engineer, Columbia graduate, nine years' experience, desires position as assistant superintendent or foreman of mine. Send for qualifications and references. Available on two weeks' notice. Box 53, Bozeman, Montana.

TIN smelting metallurgist, with over twenty years' experience smelting Bolivian tin concentrate, desires position as manager or superintendent; thoroughly competent to erect and operate plant and familiar with methods of purchasing tin concentrate. PW914—Eng. & Min. Journal.

MINE and mill superintendent open for position; technical education; 18 years' experience, last 13 in executive positions. Specialty developing ore. Understand Western desert conditions thoroughly; also extensive quicksilver experience. PW 917—Eng. & Min. Journal, San Francisco.

MINE and mill superintendent open for position; technical education; 18 years' experience, last 13 in executive positions; specialty, developing ore; understand Western desert conditions thoroughly, also extensive quicksilver experience. PW917—Eng. & Min. Journal, San Francisco.

CHIEF chemist; ten years' experience as head of prominent zinc, lead and copper smelter laboratories, wishes to communicate with a well-established company, having metallurgical, executive or chemical problems whose solution requires the services of an energetic, technically trained man of marked executive ability and broad experience. Five years of eminently satisfactory service given present employers. PW919—Eng. & Min. Journal.

In Replying to "Blind" Ads

be careful to put on envelope the key number in the ad. and also local address of office to which reply is sent.

10th Ave. at 36th St., New York.
1570 Old Colony Bldg., Chicago.
657 Leader-News Bldg., Cleveland.
935 Real Estate Trust Bldg., Phila.
501 Rialto Bldg., San Francisco.

Important

Original letters of recommendation or other papers of value should not be enclosed to unknown correspondents—send copies.

WANTED

Used Carbon (Black Diamonds) and Bortz

and fragments wanted; will pay highest prices. S. Dessau's Son, 180 Broadway, New York, N. Y.

Maurice S. Dessau, 6 Maiden Lane, N. Y.

will pay highest prices for carbon (black diamonds) and Bortz fragments, also large and small used stones. Payment made return mail for merchandise purchased.

Capital Wanted

to open up 60-ft. vein assaying $3.80 ton; gold, trace copper, leached surface; 10 miles salt water; nearly natural roadway; abundant wood and water. E. W. Mudgett, Ceiba, Honduras, Central America.

AGENTS AND SALESMEN

Do You Want Agent in Canada?

I am in position to represent you directly to the trade in Canada. Correspondence is the first essential between you and me. Irving Smith, 809 Unity Bldg., Montreal, Canada.

BUSINESS OPPORTUNITIES

Capital Available

Will supply addtional working capital for a mine ready to produce. Report with full details required. Serrenita Mining Co., Room 3061, 120 Broadway, N. Y. City.

FOR SALE

Mining Property

FOR lease or sale. Well developed mining property patented. Carries silver and lead, gold and copper, engineers report with assays furnished on request, those interested. Address Louis Stroh, Warm Springs, Montana.

Copper Wire

2000 ft. 2/0 bare copper wire, soft drawn 300 hp. Gen. El. A. C. slip ring motor. A. V. Konsberg, 226 S. LaSalle St., Chicago, Ill.

DIVIDEND NOTICE

Anaconda Copper Mining Co.

42 Broadway, New York, December 24, 1917.

The Board of Directors of the Anaconda Copper Mining Company has declared a dividend of Two Dollars ($2.00) per share upon its Capital Stock of the par value of $50 per share, payable February 25, 1918, to holders of such shares of record at the close of business at 12 o'clock noon, Saturday, January 19, 1918.

The dividend is payable only upon the $50 shares into which the Capital Stock is now divided.

All stockholders who have not converted their holdings into shares of $50 par value should do so without delay in order that they may receive their dividend promptly.

A. H. MELIN, Secretary.

Wanted: An Electrochemical Engineer

for an Exceptional Position

The MAN *we desire:*

Must be a graduate of a first-class technical university, preferably in chemical engineering, metallurgy, or electrochemistry.

Must be resourceful and of an inventive turn of mind.

Should have had several years' experience in commercial research and development work.

Should be able to direct carefully and bring to definite conclusions experimental research work instigated and performed by others.

The DUTIES *of the position will involve:*

(a) The supervision of a trained staff of technical men in the discovery and commercial development of new products and new uses for the Company's present products.

(b) Consultation in connection with the technical phases of the Company's current operations.

(c) Investigation and reporting on the practicability of new processes submitted to the Company.

The employer is a successful, growing corporation, most of whose products are manufactured by electric furnace methods.

Salary will be commensurate with the experience and ability of the applicant. The Position offers unusual opportunities for advancement to the man who can obtain results.

In replying tell the whole story of your qualifications and experience.

P913—Engineering and Mining Journal

SEARCHLIGHT SECTION

Miscellaneous

NEW RAIL

We offer for prompt delivery ten thousand tons of *new* rail of the following weights: 12 lb., 14 lb., 16 lb., 20 lb., 25 lb,
The above will be delivered from the mill, taking Chicago rate of freight.

We recommend that you telegraph your inquiries on this rail as orders will be filled in turn as they are received.

CHESTER A. PHILLIPS & CO., Old Colony Bldg., Chicago, Ill.

COMPLETE STAMP MILL

30 stamps 1050 lb. Denver Engineering Works, latest type, chrome steel shoes and dies, complete with all timbers, feeders, etc., used three months, perfect condition. Will sell in units of ten.

SOUTHWESTERN WRECKING COMPANY
El Paso, Texas

FOR SALE

STEEL SMOKE STACKS

Six of them in first-class condition. They are 4 ft. 10-in. in diameter, 60-ft. high and made of ⅜ in. steel of first-class workmanship.

Price moderate. Communicate with
J. J. L., P.O. Box 981, Buffalo

8-in. Wrought Iron Pipe

10,000 ft. standard, 28 lb., merchant pipe, good threads and couplings, immediate delivery into Mexico, duty free. All or any part.

Southwestern Wrecking Co., El Paso, Texas.

WANTED

C. E. 7 Sullivan Mining Machines, 500 volts.

1—3-in., 4-stage **Centrifugal Pump**, capable of pumping 175 gal. per min. against 300 ft. head, with speed not over 1700 R.P.M., direct connected to 500 volt D.C. motor.

1—3¼ x 12-in. horizontal **Triplex Pump**, outside and end packed, double plunger pot valve pattern power pump, fitted with single reduction of gears and motor base, motor speed 495 R.P.M., 6 single-acting water plungers, 3¼ in. diameter by 12-in. stroke, capacity 175 G.P.M., when operating at 53 R.P.M. of crank shaft, capable of discharging this water against 2000 ft. head, 12 valves, 4¼ in. diameter, each having area of 8.5 sq.in.

1—Standard pot valve type duplex **Plunger Pump**, size 18½ x 6½ x 10, to work against 500 lb. total pressure and with 100 lb. steam pressure.

Above pump specifications approximate, but can use no smaller.

5000 ft. 8-in. std. **Wrought Iron Pipe.**
5000 ft. 6-in. std. **Wrought Iron Pipe.**
500 tons 30-lb. **Steel Rails.**

UTAH FUEL CO.
Judge Bldg., Salt Lake City, Utah

Employment Experts

CORPORATIONS, INDUSTRIAL ORGANIZATIONS, ENGINEERING, MANUFACTURING AND COMMERCIAL ENTERPRISES requiring high-grade EXECUTIVES, DEP'T MANAGERS, TECHNICAL HELP, OFFICE HELP, ETC., can obtain same through our organization. We secure the right man for the position. Specify your requirements. We guarantee results and satisfaction. Each order given special attention. Any person qualified for a better position should write us.

20th CENTURY EMPLOYMENT AGENCY
642 6th Ave., New York City

500,000

FIRE BRICKS

straight and shaped for sale. Practically new. Cleaned up ready for

IMMEDIATE SHIPMENT

Also several thousand tile, various sizes.

Address **A. SCHWARZ**
1401 Broadway, Joplin, Mo.

Crusher, Air Compressor Engine, etc.

1—Set Crushing Rolls, size 36 x 24-in. face.
1—Jaw Crusher, Duplex type, size 40 x 10.
1—Jencke Corliss Engine, size 16 x 36.
1—Jaw Crusher, size 20 x 10 B.
1—Air Compressor, two-stage, steam driven, 750 ft. displacement.

THE JENCKES MACHINE CO., Ltd.
Sherbrooke, Que.

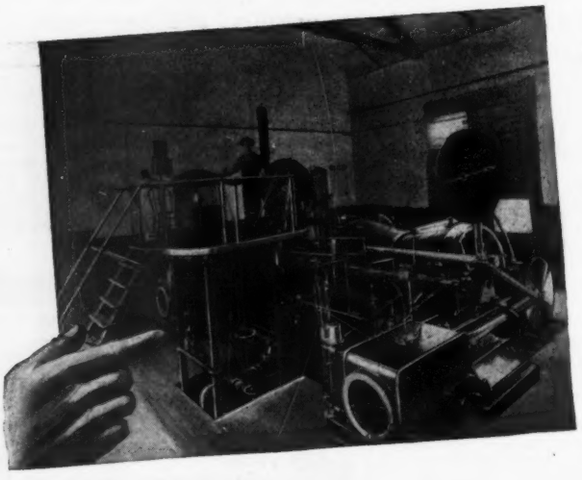
FOR SALE

DRIER

Immediate Shipment

One American Clay Machinery Company direct heat rotary drier complete; shell 48 in. x 40 ft. Address

HACKLEY MORRISON
Richmond, Va.



Steam Hoisting Engine
FOR SALE

Owing to change from steam to electrical equipment, Nordberg first motion, double conical drum, duplex steam hoisting engine, Corliss gear, cylinder 18 x 42. Drum capacity grooved for one thousand feet of 1⅛ in. rope.

TENNESSEE COPPER COMPANY
61 Broadway, New York

SEARCHLIGHT SECTION

Second Hand Equipment

POWER MACHINERY

MacGovern & Company, Inc.

HOISTS—Electric Driven

2—Mead-Morrison electric hoists, double drum, drums 30-in. dia. x 24-in face x 3-in. flange, with 40 H.P. Westinghouse motors, 500 volts D.C variable speed, 510 R.P.M.
1—Maine electric hoist, 3 drums, one drum 32½-in. face x 18-in. dia. x 7-in. flange, two drums, 32-in. face, 14-in. dia. x 9-in. flange, with 6 hand and 2 ratchet operating levers, driven by 75 H.P. Maine slip ring motors, 60 cycle.
1—Maine electric hoist, double drum, drums 12-in. dia. x 24-in. face x 6-in. flange, direct geared to 27 H.P. Maine, 60-cycle motor.
2—Maine electric hoists, 2-drum, drums 18 x 32 in., flanges 7 in., 5 operating levers, ratchet operating lever, etc., direct connected to 75 H.P. Maine slip ring motors, 3 phase, 60 cycle, 220 volts, 865 R.P.M.
2—Williamson electric hoists, 2-drum, 2-speed, drums 17-in. dia. x 32-in. face, 4½-in. flanges, direct connected to 75 H.P. General Electric ITC induction motors, 60 cycle, form M.
8—Flory electric hoists, 2-drum, 2-speed, drums 16-in. dia. x 30-in. face, 11-in. flanges, with six operating levers, direct connected to 75 H.P. slip ring, 60-cycle motors.
1—Lambert electric hoist, 2-drum, drums 16-in. dia. x 18-in. face x 5½-in. flanges, direct geared to 37 H.P. General Electric ITC motors, 3 phase, 60 cycle, 220 volts, 1200 R.P.M.
2—Lidgerwood electric mine hoists, single drum, drums 30-in. dia. x 24-in. face x 4-in. flanges, direct geared to General Electric motors, type IQC, form M, 60 cycle, 220 volts, slip ring, 830 R.P.M.
7—Lidgerwood electric mine hoists, single drum, drums 30-in. dia. x 24-in. face x 4-in. flanges, direct geared to 52 H.P. Westinghouse type 10-K series wound motors, 220 volt, direct current, 700 R.P.M.
1—Maine electric hoist, single drum, designed for a working load of 2000 lb. at 450 R.P.M., drum capacity 400 ft. of cable, motor 20 H.P., 220 volts, direct current.
1—Sheppard monorail electric hoist, capacity 4 tons, with twin Westinghouse trolley motors and General Electric hoisting motor, 60 cycle.
1—Maine electric 5-ton pillar derrick, boom 50 ft., 2 drums, 11 x 16 in., with Fort Wayne 60-cycle motor.

HOISTS—Electric-Driven Cableway

1—Flory electric cableway hoist, double drum, drums 60-in dia., grooved for ¾-in. wire rope, complete with four operating levers, etc., driven by 300 H.P. General Electric slip ring induction motor, type ITC-5017, 440 volts, 60 cycle, 600 R.P.M.

HOISTS—Belt Conveyor Coal Hoist

—Belt conveyor coal hoist, 20-in. belt, 90-ft. centers over coal hoppers, driven by 15 H.P. Crocker-Wheeler motor, 230 volts D.C., 800 R.P.M

HOISTS—Steam Driven

1—Mead-Morrison, 10 x 12 in., double drum, double cylinder.
2—Flory, 8½ x 10 in., double cylinder, double drum, drums 27 x 30 in., capacity, 3000 lb. on a single line.
1—Rawson & Morrison, twin drums, twin engine, drums 32½ in. dia. x 12-in. face x 4-in. flange, cylinders 10 x 12 in.

AIR COMPRESSORS—Belt Driven

1—Laidlaw-Dunn-Gordon, 18 x 12 x 12 in., duplex, 2-stage, 525 cu.ft. free air per min., 100 lb. pressure.
1—Ingersoll-Rand, 16½ x 25½ x 16 in., class J, compound, with intercooler and unloader, wheel 7-ft. dia. x 30-in. face.
1—Hall 13 x 7½ x 9 in., cross compound, class K, 2-stage duplex, 182 cu.ft. free air per min. at 135 R.P.M.

AIR COMPRESSORS—Steam Driven

1—Rand cross compound, 2 stage, H.P. side 22 x 24 x 48 in., L.P. side 40 x 39 x 48 in., complete with intercooler, etc., capacity 5000 cu.ft. air per min.
1—Ingersoll-Sargent cross compound, H.P. side 22 x 22½ x 42 in., L.P. side 40 x 36½ x 42 in., complete with intercooler, etc., capacity 4500 cu.ft. air per min.
1—Ingersoll-Rand, class A-1, 20 x 22½ x 24, 1000 cu.ft. air per min., at 85 to 100 lb. pressure.
1—Hall, 12 x 14 x 14, complete with unloader and usual fittings.
1—Ingersoll-Sargent, 10 x 12½ x 12, class A, piston inlet type, 360 cu.ft. air per min.
1—Chicago Pneumatic Tool Co., 9 x 9 x 11 in., class G-SS, straight line, single stage, 130 cu.ft. air per min., 100 lb. pressure, 160 R.P.M.
1—Ingersoll-Rand, 6 x 10 x 6 in., type NF-1, 114 cu.ft. air per min.

AIR COMPRESSORS—Electric Driven

1—Laidlaw-Dunn-Gordon, 25 x 15 x 18-in., 2 stage, requires 30) H.P. motor.
1—Christianson, type D-½, 50 cu. ft. air per min., with 10 H.P. motor 550 volts direct current, 1100 RPM.

We have on hand all classes of Power Machinery

MACGOVERN & COMPANY, INC.

114 Liberty Street, New York, N. Y.

DIRECT CONNECTED

GENERATOR SETS

2—Westinghouse 500 K.W., D.C. generators, 500 volts, 910 amperes, complete with switchboards and instruments, direct connected to 2—Cross Compound Pennsylvania Iron Works engines, 18 x 36 x 42.

Can be changed over to 250 volts. Ready for immediate delivery.

HARRY E. SALZBERG & CO.
30 Church St., New York, N. Y.

FOR SALE

AIR COMPRESSOR

Corliss Type

Size 18 x 32 x 30 x 18 x 36. Manufactured by Laidlaw-Dunn-Gordon Company. Now in operation and in excellent condition.

Address:

THE PINE BLUFF COMPANY
Pine Bluff, Arkansas

FOR QUICK SALE

STEAM PUMPS

1—18 x 10¼ x 10 in. Worthington duplex steam pump.
1—16 x 10¼ x 10 in. Smith-Valle duplex pump.

RAIL

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2—42-in. single drum, close mining hoists, direct-connected to 40-hp. 4-cylinder automobile-type gas engine.

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57

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"Our results from the Journal have been very satisfactory. We can trace a great number of our large sales directly to your Searchlight Section, and are having inquiries from practically every mining section of the world for material we are advertising in your pages."

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"Thanks to the advertising in the Engineering and Mining Journal, my Empire Drill has been disposed of."

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"Regarding our ad which you published recently, will say the results have been very satisfactory.
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A SEARCHLIGHT is an eye to pierce the darkness. And so—

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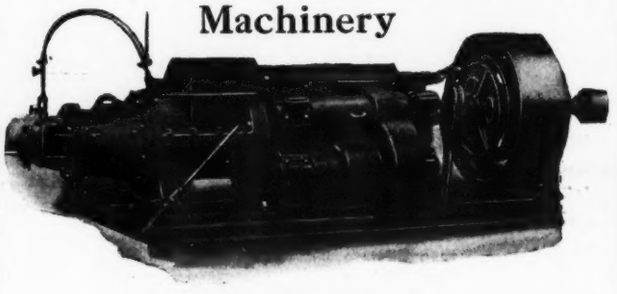

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Black and Galvanized—strong, durable and rust-resistant. APOLLO-KEYSTONE Galvanized Sheets are unequaled for Culverts, Tanks, Roofing, Flumes, and all forms of exposed sheet metal work.

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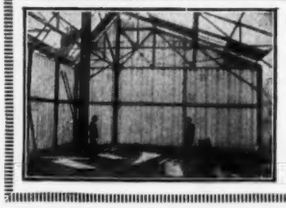

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Speedily erected economical, sanitary and, fireproof.

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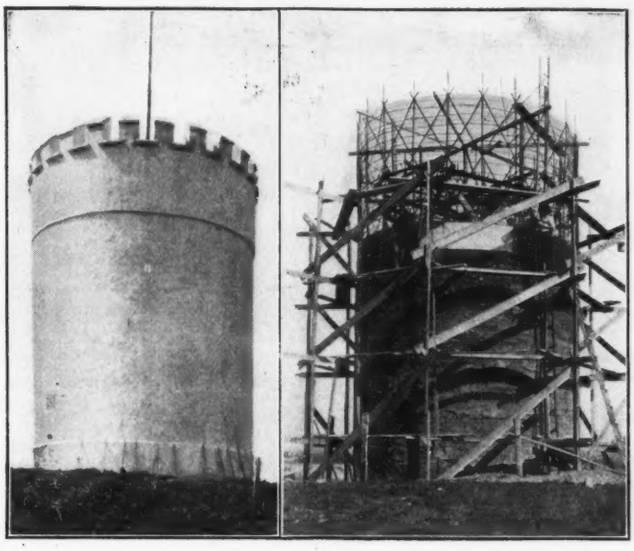
Build Your Tanks of "GUNITE"



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The Cement-Gun, which produces the hard impervious material known as **"Gunite"** has a wide range of service in mines and mills.

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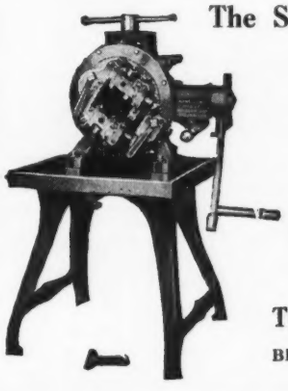

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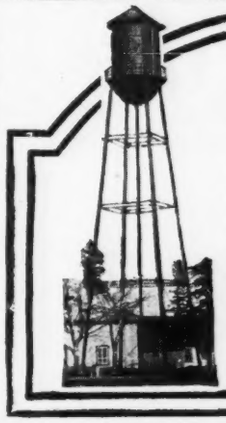

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Permanence — that's the keynote of a Caldwell Hemispherical Tank and Tower.

This tower contains nothing but steel throughout. Its latticed columns are carefully and properly riveted and the whole structure is designed and constructed according to engineering principles. Fireproof, storm-proof and repair-proof.

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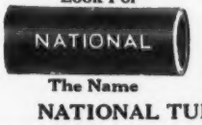

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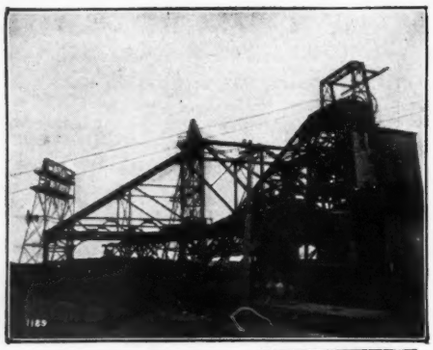
Manufacturers of Steel Structures of all classes particularly BRIDGES AND BUILDINGS



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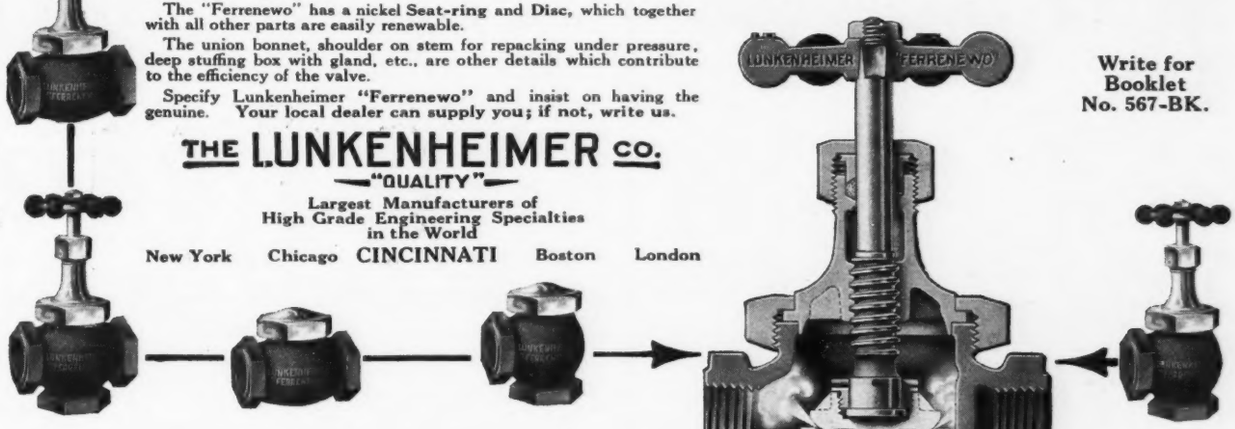

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Abolishes leaks in air hose. A big improvement over the types. Prevents wear.

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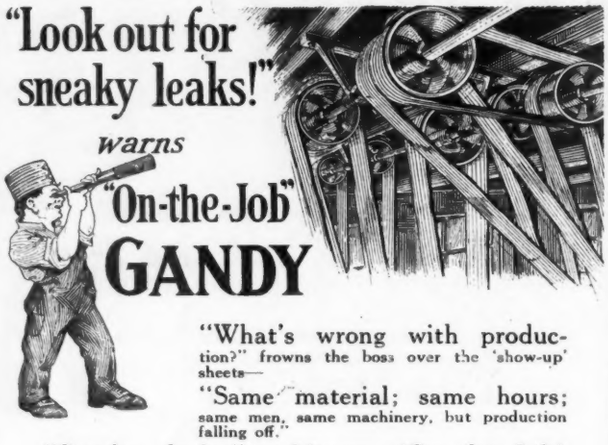

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GANDY

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"Sneaky leaks," whispers **'On-the-Job' GANDY.** "A slip here and a slack there aggregate short production—real loss!

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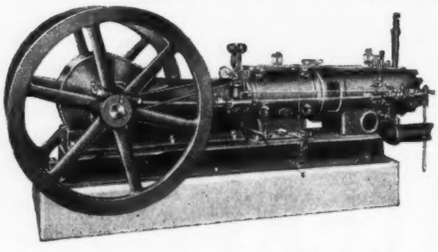
Will Materially Reduce Compressed Air Costs



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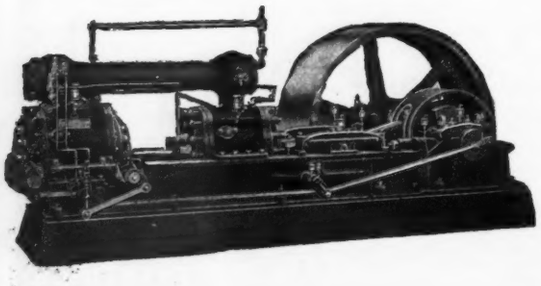

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These improvements mark a new era in compressor construction. They gain the instant and favorable attention of all skilled engineers. For the usual hackneyed claims of *economy, durability* and *efficiency,* let our forty years' experience be an assurance of adequate and discerning attention to every feature.

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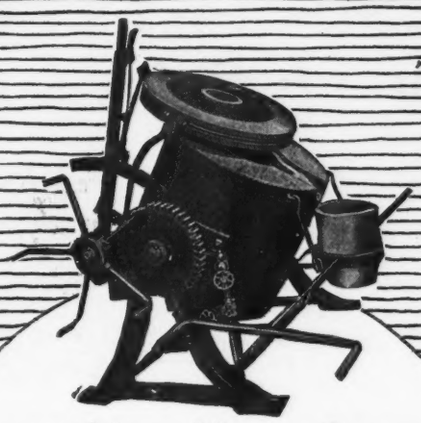

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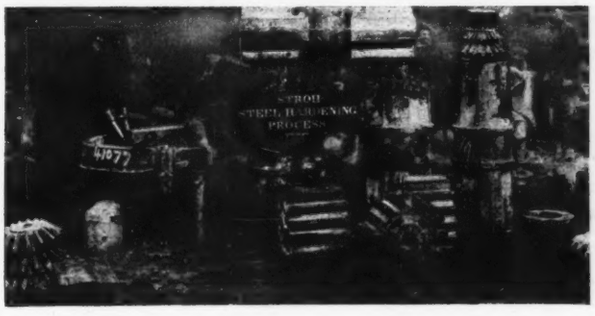

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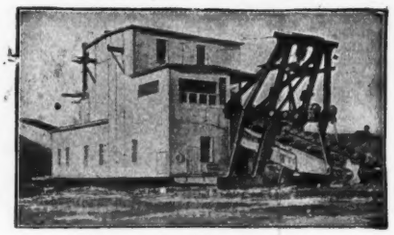

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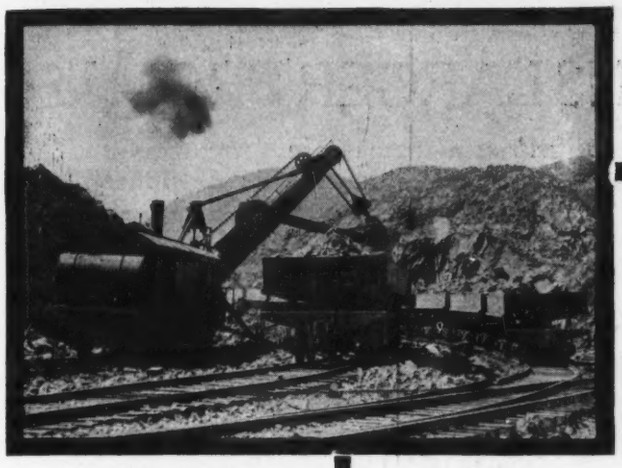

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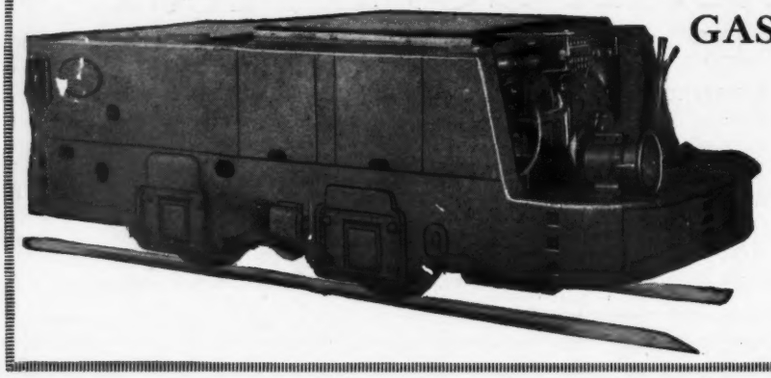

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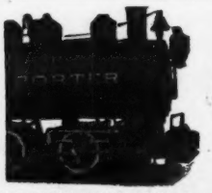

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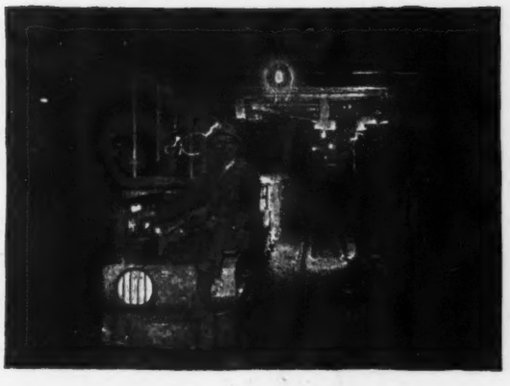

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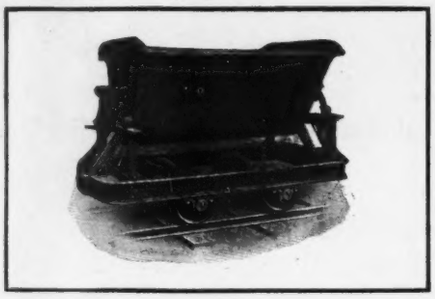

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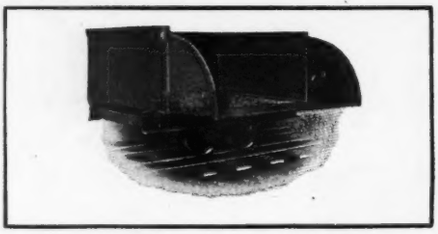

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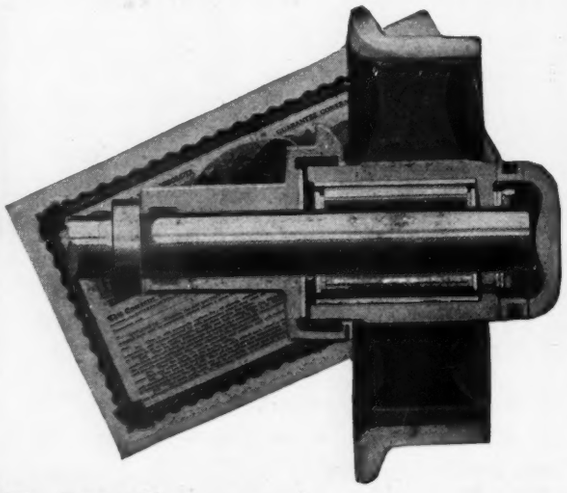

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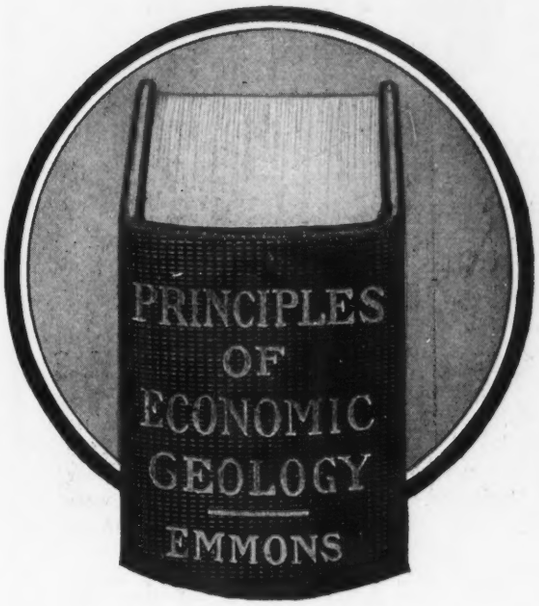

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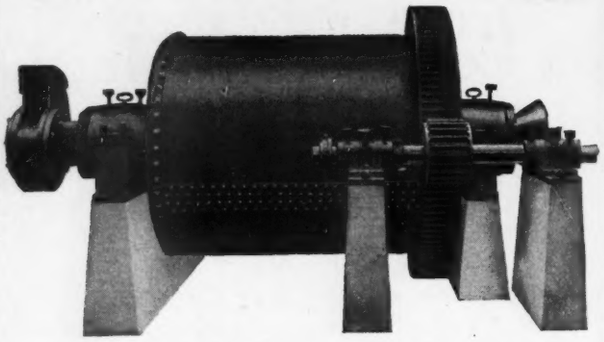

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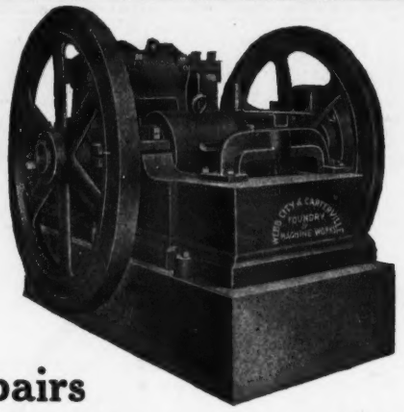

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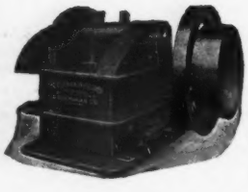

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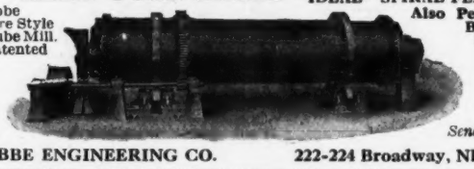

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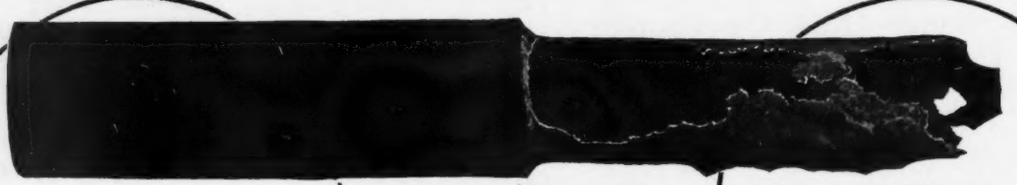

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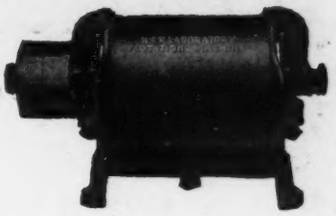

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Ward, Howard R., Consulting Engineer. Address c/o American International Corporation, 120 Broadway, New York City.

Waring & Williams Laboratories, The, Chemical analyses of all kinds. Webb City, Mo.

Wartenweiler, Otto & Co., Engineers and Contractors. Mining and Metallurgical Plants. Hollingsworth Bldg., Los Angeles, Calif.

Washburne, C. W., Geologist. Oil, Gas and Coal. 66 Liberty St., New York.

Watson, J. Craig, A. M. I Mech. E. (London), M. C., M. I., M. E. Reports made on mining properties in the Porcupine and Kowkash Goldfields, So. Porcupine, Ont.

Watson, R. B., Con. Min. Eng. 165 Broadway, New York Gen. Mgr., Nipissing Mining Co., Ltd., Cobalt.

Watson, William, E. M. M. E., Mining Engineer. Address Room 412, 52 Wall St., New York.

Weed, Walter Harvey, Mining Geologist and Engineer. Examinations. Editor, The Mines and Copper Handbook. 29 Broadway, New York. Cable: "Minexam."

Weekes, Frederic R., Mining Engineer. 42 Broadway, New York.

Welch, Max J., Designing and Supervising Engineer of Construction. 1210 Hollingsworth Bldg., Los Angeles, Calif.

Weld, C. M., Consulting Mining Engineer. 2 Rector St., New York, N. Y Telephone: 2356 Rector. Cable Address: "Mineld," New York.

Wells, Jas. S. C., Consulting Mining and Metallurgical Engineer. N. 15th St., Cañon City, Colorado.

Wenstrom, Olaf, Mining Engineer, 53 State St., Boston, Mass. Cable: "Olavo." Code: Bedford-McNeill.

Westervelt, William Young, Consulting Mining Engineer. 17 Madison Ave., New York. Cable Address: "Casewest." N. Y. McNeill Code.

Wethey, Arthur H., Mining and Metallurgical Engineer. Lemoore, Calif.

Wheeler, H. A., Mining Engineer. Reports on Oil and Mining Properties. 408 Locust St., St. Louis, Mo. Cable: "Wah." St. Louis.

White, Rush J., Mining Engineer. Shoshone Bldg., Wallace, Idaho.

Whiting, Lowe, Mining Engineer. First National Bank Bldg., Iron River, Mich.

Wiard, Edward S., Mining and Metallurgical Engineer. 422 Boston Bldg., Denver, Colo.

Wilding, James, Mine Valuation. Copper and Lead Smelting. Concentration by Flotation. 825 Merchants' Exchange Bldg., San Francisco.

Wiley, W. H., Mining Engineer. Palm Drive, Glendora, Calif.

Wilfley, Clifford R., Mining Engineer. Manager, Barstow Mine. Private ore-testing laboratory. Ouray, Colo.

Wilkens, H. A. J., Mining Engineer. Wilkens & Devereux, Consulting Mining Engineers. 120 Broadway, New York.

Wilkens & Devereux, H. A. J. Wilkens, W. B. Devereux, Jr., J. H. Devereux. Consulting Mining Engineers. 120 Broadway, New York; London, Eng.; Mexico D. F. Cable: Kenreux.

Wilmot, H. C., Mining Engineer. 32 W. 40th St., New York City.

Wilson, George Benton, Consulting Mining Engineer. With the American Smelting & Refining Co., Salt Lake City, Utah.

Wilson, W. A., Mining Engineer. 406 Dooly Block, Salt Lake City, Utah.

Wilson, W. C. H., Consulting Mine, Mill and Smelter Accountant. Lundbreck, Alberta, Canada. Sudbury, Ont., Canada.

Winchell, Horace V., Consulting Mining Geologist. 826 First National-Soo Line Bldg., Minneapolis, Minn. Cable: Racewin.

Winwood, Job H., Mining Engineer. Continental Bank Bldg., Salt Lake City, Utah.

Wiseman, Philip, Min. Eng. 1210 Hollingsworth Bldg., Los Angeles, Calif. Cable: "Filwiseman." Codes: Western Union, Bedford-McNeill.

Wolf, Harry J., Mining Engineer. First National Bank Bldg., Denver, Colo. Cable Address: "Wolf," Denver. Code: Bedford-McNeill.

Wood, Ernest Clifford, Con. Min. Eng. Examinations and Reports. Developments directed. 401 Empire State Building, Spokane, Wash.

Wood Ore Testing Co., The Henry E., Assayers. Ore Tested in Carload Lots. Write for Circulars. 1734 Arapahoe St., Denver, Colo.

Worcester, S. A., Mechanical Mining Engineer. Mill Tests, Design, Construction, Management. Special Ore-Handling Plants. Victor, Colo.

Worth, John G., Mining Engineer. 836 Real Estate Trust Bldg., Philadelphia, Penn. Room 1100, 66 Broadway, New York.

Wrampelmeier, E. L. S., Mining Engineer. 222 Scott St., Tucson, Ariz.

Wright, Charles Will, Mining Engineer. Ingurtosu, Sardinia, Italy. Cable: "Wright," Arbus. Code: Bedford-McNeill.

Wright, Louis A., Casilla No. 125 D, Santiago, Chile, S. A. Cable: Lawright, Santiago. Code: Bedford-McNeill.

Y

Yeatman, Pope, Mining Engineer. Will resume independent practice Sept. 1, 1916. 111 Broadway, New York. Cable: Ikona. Code: McNeill.

Young, Jacob W., Mining Engineer. c/o H. T. Birr, 230 First Natl. Bank Bldg., Oakland, Calif.

Yung, M. B., M. E., Examinations in China. 26 Des Voeux Road, Central, Hong Kong, China. Cable: "Anme." Codes: West. Union, Moreing & Neal's.

Z

Zalinski, Edward R., Mining Engineer. 821 Newhouse Bldg., Salt Lake City. Examination Geological Mapping, Development.

WHAT AND WHERE TO BUY

Equipment, Apparatus and Supplies Used by the Metal Mining and Refining Industry with Names of Manufacturers and Distributors

Acetylene Apparatus
Davis-Bournonville Co.
See "Oxyacetylene Apparatus."

Acids
Grasselli Chemical Co., The, Cleveland, Ohio.

Acid, Mask
Multi-Metal Separating Screen Co., 253 W. 19th St., New York, N. Y.

Acid, Sulphuric
American Zinc & Chemical Co., Langeloth, Pa.
American Zinc, Lead & Smelting Co., 55 Congress St., Boston, Mass.
Hegeler Zinc Co., The, Danville, Ill.
Illinois Zinc Co., Peru, Ill.
Matthiessen & Hegeler Zinc Co., La Salle, Ill.
New Jersey Zinc Co., 55 Wall St., New York.

Agitators
Caldwell Co., W. E., 2170 Brook St., Louisville, Ky.
Dorr Co., Denver, Colo. Branches: New York and London, England.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Amalgamators
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Lane Mill & Machinery Co., Los Angeles, Calif.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Senn Concentrator Co., 611 First Nat. Bank Bldg., San Francisco, Calif. Senn Panning Motion Batea Amalgamator; cap. 50 tons per 24 hr.; diam., 8 ft.; water required in pulp or sand, about 200 gal. per ton dry ore; reqs. ½ hp.; shipping weight, 3500 lb. Pulp or placer sand is fed down into bowl where swirled around with liquid quick. Coarse gold is amalgamated and traveling amalgam and quick caught. Continuous feed forces lighter part of solids from bowl and onto plates covering batea top, where panning motion keeps pulp loose and settles fine gold onto plates. Escape of quick or amalgam is prevented.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Asbestos
Asbestos Protected Metal Co. Pittsburgh, Pa.

Assayers
Baker & Co., Inc., Newark, N. J.
Ledoux & Co., Inc., 99 John St., New York.
Pitkin, Inc., Lucius, 47 Fulton St., New York.

Axles, Locomotive
American Locomotive Co., 30 Church St., N. Y.

Balances
Ainsworth & Sons, Wm., Denver, Colo.
Denver Fire Clay Co., Denver, Colo., U. S. A. Analytical, assay, button balances, made by Keller, Ainsworth, Troemner, Thompson, Oertling, Voland, Becker, Sartorious and Kern.
Mine & Smelter Supply Co., The, Denver, Colo. Branches: Salt Lake City, El Paso, New York.
Thompson Balance Co., Denver, Colo.
Troemner, Henry, 911 Arch St., Phila., Pa.

Bearings, Ball and Roller
Enterprise Fdry. & Mach. Co., Bristol, Tenn.

Belting, Conveyor
Boston Belting Co., Boston, Mass.
Gandy Belting Co., Baltimore, Md
Goodrich Co., The B. F., Akron, Ohio. Rubber for hardest service. "Longlife" and "Maxecon" grades for continuous operation and maximum life.
Goodyear Tire & Rubber Co., The, Akron, Ohio.
Peerless Rubber Mfg. Co., 31 Warren St., N.Y.C.
Robins Conveying Belt Co., New York.

Belting, Elevator
Goodrich Co., The B. F., Akron, Ohio. Special rubber elevator belts.
Goodyear Tire & Rubber Co., The, Akron, Ohio.
Peerless Rubber Mfg. Co., 31 Warren St., N.Y.C.

Belting, Transmission
Gandy Belting Co., Baltimore, Md.
Goodrich Co., The B. F., Akron, Ohio. Rubber belts for drives. Friction surface and rubber covered.
Graton & Knight Mfg. Co., Worcester, Mass. "Spartan," water, steam, oil and heat resisting.
Goodyear Tire & Rubber Co., The, Akron, Ohio.
Peerless Rubber Mfg. Co., 31 Warren St., N.Y.C.
Shieren Co., Charles A., New York City. "Duxbak." Moisture-resisting leather.

Bit Sharpeners
Mayer Bros. Co., Mankato, Minn. "Little Giant" combination pick point and chisel bit dies and "Little Giant" pick point dies.

Blasting Supplies
Aetna Explosives Co., 2 Rector St., New York.

Blowers
Connersville Blower Co., The, Connersville, Ind. Rotary positive type. Two impellers, balanced at all speeds.
General Electric Co., Schenectady, N. Y.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Roots C., P. H. & F. M., Connersville, Ind. Low-pressure sizes to 42,105 cu.ft. per min. High-pressure up to 10 lb. Rotary positive pressure.

Blowers, Centrifugal
Ingersoll-Rand Co., 11 Broadway, New York. Turbo-blowers for blast and converter work All pressures and volumes.

Boilers
Abendroth & Root Mfg. Co., 45 Bway., New York.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Mine & Smelter Supply Co., The, Denver, Colo. Branches: Salt Lake City, El Paso, New York.
Moore & Co., C. C., Engineers, San Francisco, Cal.
Morse Bros. Mach. & Supply Co., Denver, Colo.

Boiler Tubes
National Tube Co., Pittsburgh, Penn.

Boilers, Locomotive
American Locomotive Co., 30 Church St., N. Y.

Books, Technical
McGraw-Hill Book Co., Inc., 239 W. 39th St., New York. Branches: London and Berlin.

Boots and Shoes
Goodrich Co., The B. F., Akron, Ohio. White rubber mining boots and shoes. (Red line around top.)

Brick, Fire
Harbison-Walker Refractories Co., Pittsburgh, Pa.

Bridges, Ore Handling
American Bridge Co., 30 Church St., New York.

Bridges, Suspension
Roebling's Sons Co., John A., Trenton, N. J.

Buckets, Elevator
Hendrick Mfg. Co., Carbondale, Penn.

Buckets, Orange Peel and Clamshell
Industrial Works, Bay City, Mich. Designed for quick attachment or removal.

Buckets, Ore
Watt Mining Car Wheel Co., Barnesville, Ohio.

Building Paper
Asbestos Protected Metal Co. Pittsburgh, Pa.

Cables, Insulated Telephone
Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y.

Cableways
Flory Mfg. Co., S., Bangor, Penn.
Roebling's Sons Co., John A., Trenton, N. J.

Cages, Hoisting
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Ottumwa Iron Works, Ottumwa, Iowa.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Candles
Standard Oil Co., Chicago, Ill.

Carbons and Bortz
Byron & Hall, 116 Broad St., New York.
Diamond Drill Carbon Co., World Bldg., Park Row, New York, N. Y.

Cars, Gable Bottom
Easton Car & Construction Co., Easton, Penn.

Cars, Hopper
Easton Car & Construction Co., Easton, Penn.

Cars, Ore
Allis-Chalmers Mfg. Co., Milwaukee, Wis
Atlas Car & Mfg. Co., Cleveland, Ohio.
Easton Car & Construction Co., Easton, Penn.
Sanford-Day Iron Co., Knoxville, Tenn. Capacity 8 to 25 cu.ft. Any gage. Steel; end or side dump.
Traylor Engineering & Mfg. Co., Allentown, Pa.
Watt Mining Car Wheel Co., Barnesville, Ohio.

Cars, Quarry
Easton Car & Construction Co., Easton, Penn.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Cement Floors
Asbestos Protected Metal Co., Pittsburgh, Pa.

Cement, Iron
Smooth-On Mfg. Co., Jersey City, N. J. In 1-, 5-, 10- and 25-lb. cans. "Smooth-On" iron cements, metallize and become part of metal to which applied.

Cement-Placers, Jet
Cement-Gun Co., Inc., Allentown, Penn. Cable: Cementgun. Branches: New York, Chicago, Salt Lake City, Seattle, and Vancouver, B. C. Three sizes. Capacities variable according to number of nozzles, hose, sizes and air pressures. The "Cement-Gun" is a portable apparatus for depositing cement or "Gunite" coatings by air pressure for covering old and new structures, building new ones and grouting or filling cracks. See advertisement.

Chains, Transmission
Morse Chain Co., Ithaca, N. Y. For drives up to 5000 hp. Reduction ratios to 7 and 8 to 1. "Rocker-Joint" to reduce wear; quiet, positive.

Chemical Apparatus
Heil Chemical Co., Henry St. Louis, Mo.
Mine & Smelter Supply Co., The, Denver, Colo. Branches: Salt Lake City, El Paso, New York.

Chemicals
General Chemical Co., 25 Broad St., New York.
Grasselli Chemical Co., The, Cleveland, Ohio.
Roessler & Hasslacher Chemical Co., New York.

Circuit Breakers, Electric
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Classifiers
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Colorado Iron Works Co., Denver, Colo., U. S. A. "Akins" spiral revolving in inclined trough.
Deister Machine Co., Ft. Wayne, Ind., U. S. A.; No. 1 London Wall Bldgs., London Wall, E. C. Capacity on 60-mesh 20 tons per 24 hr. Cast-iron barrel containing staggered inverted hollow-slotted cones, acting as baffles. Incoming water takes fines to top, coarse material sinking. Send for Bulletin No. 5.
Denver Engineering Works Co., Denver, Colo. "Richards" pulsator for table feed; "Ovoca" for sand slime separation.
Dorr Co., Denver, Colo.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
James Ore Concentrator Co., Newark, N. J.
Mine & Smelter Supply Co., The, Denver, Colo. Branches: Salt Lake City, El Paso, New York.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Clutches, Friction
Caldwell Co., W. E., 2170 Brook St., Louisville, Ky.
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.

Compressors, Air
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Bury Compressor Co., Erie, Penn.
Chicago Pneumatic Tool Co., Chicago, Ill. Fuel oil, gas, steam power driven.
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Ingersoll-Rand Co., 11 Broadway, New York. Branches: Boston, Birmingham, Butte, Cleveland, Chicago, Denver, Duluth, El Paso, Knoxville, Los Angeles, Philadelphia, Pittsburgh, St. Louis, Seattle, Salt Lake City, New Orleans, Scranton, Juneau. "Imperial," "Ingersoll-Rogler," "Turbo"—all sizes, pressures, types. Stationary and portable.
Moore & Co., C. C., Engineers, San Francisco, Cal.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Nordberg Mfg. Co., Milwaukee, Wis.
Norwalk Iron Works Co., So. Norwalk, Conn. Size to suit work.
Sullivan Machinery Co., Chicago, Ill., U. S. A. Steam and power drive. Tandem compound Corliss, angle compound, belt or motor drive, portable, underground motor driven.

Concentrators, Table
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Butchart, W. A., 603-05-07 Mercantile Bldg., Denver, Colo. One model in two sizes: 6'x16' and 3'x8'. Capacities 5 to 150 tons per 24 hr., according to class and mesh of feed. Two-mineral separations. Structural steel and cast-iron base and mounting regular equipment. Built to order without base for mounting on concrete piers. Line shaft or individual motor drive. Reinforced steel deck; lineoleum or cement top. Reciprotor-type head motion, water and dustproof, completely self-oiling.
Deister Concentrator Co., The, Ft. Wayne, Ind. Prices on application. Deister No. 3 slimer for fines and slimes in either single- or double-deck types; Deister No. 4 for sands either roughing or finishing, classified or unclassified, in single-deck type only. Deister No. 5 for coarse and fine classified sands in either single- or double-deck type. Overstrom table for fine and coarse feeds has large capacity for roughing or finishing in either single- or double-deck type. Head motion and under construction for all tables designed to reduce upkeep and operating costs. Table makes more than one-product concentrate if desired.
Deister Machine Co., 1933-2003 E. Wayne St., Ft. Wayne, Ind., U. S. A. No. 1 London Wall Bldgs., London Wall, E. C. Prices on application. Single- or double-deck Deister "Simplex" sand concentrators, standard size; single- or double-deck Deister "Simplex" slime concentrators; single- or double-deck Deister "Simplex" sand concentrators, large size; Deister multiple-deck tilting slimers, 6- or 12-deck type; Deister cone baffle classifier; Deister patented plateau and riffling system for all types of shaking tables. Double-deck tables save mill room, launders, conveyors and power. Deister simplex rougher has large capacity for roughing and at the same time produces a clean concentrate, all in one operation. Agents: William L. Reeder, 410 Consolidated Building, Johannesburg, South Africa; Takata & Co., 2 Yeiraku-cho, Nichome, Kojimachi-ku, Tokyo, Japan.
Denver Engineering Works Co. Denver, Colo.
Hendrie & Bolthoff M. & S. Co., Denver, Colo. "Isbell" takes unclassified feed. Card concentrators.
James Ore Concentrator Co., Newark, N. J.

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Morse Bros. Mach. & Supply Co., Denver, Colo.
Senn Concentrator Co., 611 First Nat. Bank Bldg., San Francisco, Calif.
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Traylor Engineering & Mfg. Co., Allentown, Pa.

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Jeffrey Mfg. Co., The, 974 N. 4th St., Columbus, O.

Conveyors, Belt

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Crusher Parts

Traylor Engineering & Mfg. Co., Allentown, Pa.

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Bacon, Earle C., Havemeyer Bldg., New York.
Braun Corporation, The, Los Angeles, Calif.
Laboratory steel frame jaw crushers.
Braun-Knecht-Heimann Co., San Francisco, Cal
Buchanan Co., Inc., C. G., New York.
Chalmers & Williams, Chicago Heigths, Ill.
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Denver Fire Clay Co., Denver Colo., U. S. A.
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Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Jeffrey Mfg. Co., The, 974 N. 4th St., Columbus, O.
Kent Mill Co., 10 Rapelyea St., Brooklyn, N. Y.
Revolving concave ring. Rolls track inside.
Mine & Smelter Supply Co., The, Denver, Colo.
Branches: Salt Lake City, El Paso, New York.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Smith Eng. Wks., 3195 Locust St., Milwaukee, Wis.
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Stroh Steel-Hardening Process Co., Pittsburgh, Pa.
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Universal Road Machinery Co., Kingston, N. Y.
United Iron Works Company, Joplin, Mo.
Webb City & Carterville Foundry & Machine Works, Webb City, Mo.
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Cups, Grease (See "Grease Cups")

Cutting Apparatus

Davis-Bournonville Co.
See "Oxyacetylene Apparatus."

Cyanide

Roessler & Hasslacher Chemical Co., New York.

Cylinders, Steel

Naional Tube Co., Pittsburgh, Penn.

Diamonds, Black (See "Carbons and Bortz")

Doors, Automatic Mine
(See Mine Doors, Automatic)

Dredges

Flory Mfg. Co., S., Bangor, Penn.
Morris Machine Works, Baldwinsville, N. Y.
New York Eng. Co., 2 Rector St., New York.
Union Construction Co., San Francisco, Calif.
Yuba Manufacturing Co., The, San Francisco, Calif.

Drilling, Core

Longyear Co., E. J., Minneapolis.
Pennsylvania Drilling Co., Pittsburgh, Penn.
Sullivan Machinery Co., Chicago, Ill., U. S. A.

Drills, Churn

Union Construction Co., San Francisco, Calif.

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Sullivan Machinery Co., Chicago, Ill., U. S. A.

Drills, Diamond

Longyear Co., E. J., Minneapolis, Minn.
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Sullivan Machinery Co., Chicago, Ill., U. S. A.

Drills, Electric

Denver Rock Drill Mfg. Co., Denver, Colo.
Ingersoll-Rand Co., 11 Broadway, New York.

Drills, Hammer

Chicago Pneumatic Tool Co., Chicago, Ill.
Cleveland Rock Drill Co., Cleveland, Ohio.
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McKiernan-Terry Drill Co., 230 Bway., New York.
Sullivan Machinery Co., Chicago, Ill., U. S. A.
Whitcomb Co., Geo. D., Rochelle, Ill.

Drills, Piston

Chicago Pneumatic Tool Co., Chicago, Ill.
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Drills, Prospecting

Ingersoll-Rand Co., 11 Broadway, New York.
Longyear Co., E. J., Minneapolis.
New York Eng. Co., 2 Rector St., New York.
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Sullivan Machinery Co., Chicago, Ill., U. S. A.

Dryers, Ore

American Process Co., 68 William St., New York.
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Colorado Iron Works Co., Denver, Colo.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Ruggles-Coles Eng. Co., York, Penn.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Dust Hood

Multi-Metal Separating Screen Co., 253 W. 19th St., New York, N. Y.

Dust Protectors (See "Respirators")

Dumps, Pneumatic Rotary

Wood Equipment Co., McCormick Bldg., Chicago, Ill.

Dynamite

Aetna Explosives Co., 2 Rector St., New York.

Electrical Supplies

Mine & Smelter Supply Co., The, Denver, Colo.
Branches: Salt Lake City, El Paso, New York.

Elevators, Bucket

Robins Conveying Belt Co., New York.
Stephens-Adamson Mfg. Co., Aurora, Ill.
See advertisement on inside front cover for branch office addresses.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Employees

Business Men's Clearing House, Denver, Colo.
Supts., assayers, mill men sent all parts of world.

Engines, Gas and Gasoline

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chicago Penumatic Tool Co., Chicago, Ill.
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.
Morse Bros. Mach. & Supply Co., Denver, Colo.

Engines, Oil

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Chicago Pneumatic Tool Co., Chicago, Ill.
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Ingersoll-Rand Co., 11 Broadway, New York.
Morse Bros. Mach. & Supply Co., Denver, Colo.

Engines, Steam

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Morse Bros. Mach. & Supply Co., Denver, Colo.

Exhausters

Connersville Blower Co., The, Connersville, Ind.
Morse Bros. Mach. & Supply Co., Denver, Colo.

Excavating Machinery

Osgood Co., The, Marion, Ohio.

Feeders, Ore

James Ore Concentrator Co., Newark, N. J.
Stephens-Adamson Mfg. Co., Aurora, Ill.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Filter Paper

Heil Chemical Co., Henry, St. Louis, Mo.

Filters

Colorado Iron Works Co., Denver, Colo.
"Portland" continuous revolving drum. For cyanide slimes, flotation concentrates, etc.
Scaife & Sons Co., Wm. B., Pittsburgh, Penn.
Traylor Engineering & Mfg. Co., Allentown, Pa.
United Filters Corp., Felt Bldg., Salt Lake City, Utah.

Fire Forcing Presses

Wood & Co., R. D., Philadelphia, Penn.

Fireproof Roofing

Asbestos Protected Metal Co., Pittsburgh, Pa.

Flange Presses

Wood & Co., R. D., Philadelphia, Penn.

Flexible Tubing

Bemis Bro. Bag Co., 400 Poplar St., St. Louis, Mo.
Sizes: 8-, 12- and 16-in. diameters; 100- and 200-ft. lengths.
"Flexoid" is a canvas tubing, flexible, portable and light. Furnished in various lengths and diameters, with simple, adjustable, metal connections. Air-tight and designed for use with fumes or acid waters. Adapts itself to irregular flooring or can be suspended from roof.

Flotation Machines

Southwestern Eng. Co., Inc., 106 W. 3rd St., Los Angeles, Calif.

Flotation Oils

Flotation Oil & Chemical Co., 2 Rector St., N. Y.
General Naval Stores Co., 175 Front St., N. Y.
Pine oils, pine tar oils, turpentines, coal tar oils, wood creosotes, etc.
Georgia Pine Turpentine Co., 160 Perry St., New York City.
Pensacola Tar & Turpentine Co., Gulf Point, Fla.

Forges

Denver Fire Clay Co., Denver, Colo., U. S. A.
Oil-fired for drill steel. Send for catalog.
Ingersoll-Rand Co., 11 Broadway, New York.
Monarch Eng. & Mfg. Co., Baltimore, Md.

Framers, Timber

Denver Engineering Works Co., Denver, Colo.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.

Furnaces, Assay

Braun Corporation, The, Los Angeles, Calif.
Braun-Knecht-Heimann Co., San Francisco, Cal.
Denver Fire Clay Co., Denver, Colo., U. S. A.
"Case" patent. One-, two- or three-muffle design unit system, low pressure air.
Mine & Smelter Supply Co., The, Denver, Colo
Branches: Salt Lake City, El Paso, New York.

Furnaces, Bullion Melting

Braun Corporation, The, Los Angeles, Calif.
Braun-Knecht-Heimann Co., San Francisco, Cal
Denver Fire Clay Co., Denver Colo., U. S. A.
"Case" patent. Oil-fired, low-pressure ir, high temperatures quickly attained.
Send for catalog.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Furnaces, Crucible, Tilting and Refining

Monarch Engineering & Mfg. Co., 1206 American Bldg., Baltimore, Md.

Furnaces, Crucible, Tilting Metal

Monarch Engineering & Mfg. Co., 1206 American Bldg., Baltimore, Md.

Furnaces, Electric

General Electric Co., Schenectady, N. Y.

Furnaces, Mechanical Roasting

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Dwight & Lloyd Sintering Co., Inc., N. Y City.
General Chemical Co., Herreshoff Furnace Dept. B, 25 Broad St., New York, N. Y.
Ten sizes, 5 to 7 hearths, 381 to 1925 sq.ft. hearth area.
Cylindrical steel shell contains vertically superimposed hearth. By rabble arms operated from central vertical shaft, roasting ore travels from center of top hearth, down through lower ones, discharging from rim of lowest. Heated air for combustion travels upward.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Wedge Mechanical Furnace Co., 115 Chestnut St., Philadelphia.
Varying stock sizes, number of hearths and hearth areas.
Hearths placed one above the other vertically all enclosed in suitable shell. Vertical shaft revolves in center, raking ore on hearths, by rabbles and teeth attached to arms. Ore travels through furnace from top to bottom. To correct inequalities in the supply of heat combustion gases pass through heating chambers between hearths, as well as to hearths themselves. External fireboxes communicate with the heating chambers through flues. Central shaft designed to be accessible.
Send for catalog.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Furnaces, Smelting

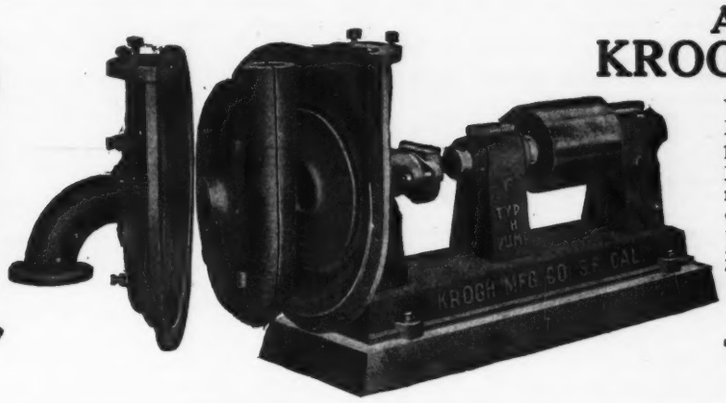
Colorado Iron Works Co., Denver, Colo.
Morse Bros. Mach. & Supply Co., Denver, Colo.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Fuses, Electric

Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.
Wood & Co., R. D., Pittsburgh, Penn.

Gas Producers

Wellman-Seaver-Morgan Co., The, Cleveland, O.



About the Liners—in KROGH SAND PUMPS

We spent much time developing the liners for Krogh Pumps—because the liner is the vital part.

Krogh Liners and Impellers therefore are made of special chilled car wheel iron. The chill runs so deep that when the liner wears to soft metal it would have had to be replaced in any event.

This means a big saving in renewals.

Write for Bulletin No. 79.

The Krogh Pump Mfg. Co.
147 Beale St., San Francisco, Cal.

PACKINGLESS ACID PUMPS AND VALVES

For Chemical Solutions

The Chemical Pump & Valve Company
Perth Amboy, N. J.

P. H. & F. M. ROOTS CO., Connersville, Ind.

Manufacturers of

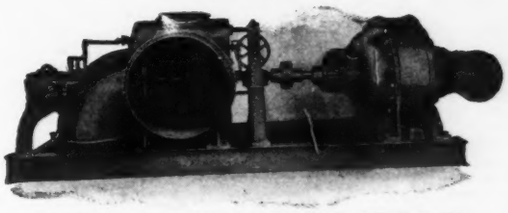
Rotary Blowers, Gas Exhausters, Water Pumps Vacuum Pumps

SEE HALF-PAGE ADVERTISEMENT JAN. 12 ISSUE

New York, 120 Liberty St. **Chicago, Peoples Gas Bldg.**

Samson Turbine Water Wheels

All Designs—High Speeds—High Horse Powers High Efficiencies



Write for our Latest Turbine Water Wheel Bulletin 54.

The James Leffel & Co., **306 Lagonda Street Springfield, Ohio, U.S.A.**

Sales Engineers

L. B. Dow, Inc., 79 Milk St., Boston, Mass. The Colby Engineering Co., Inc., 70 First St., Portland, Ore. H. H. White, 378 Piedmont Ave., Atlanta, Ga William Hamilton Co., Ltd., Peterborough, Ont., Canada.

SCREENS OF ALL KINDS

Chicago Perforating Co.
2445 West 24th Place
Tel. Canal 1459 **CHICAGO, ILL.**

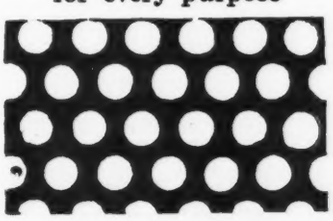
FJAB

"The Uniformly good drill Steel"

A. MILNE & CO. New York Boston

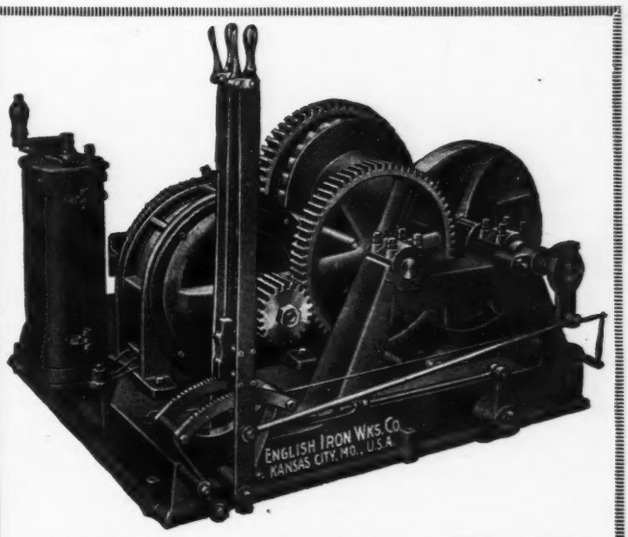
"HENDRICK" Perforated Metals

for every purpose



Conveyor Trough and Flights. Buckets (plain and perforated). Stacks and Tanks. General Sheet Iron Work.

Hendrick Mfg. Co., Carbondale, Pa.
New York Office: 30 Church St.



Single Friction Drum Electric Hoist

This compact Friction Drum Hoist is designed and constructed for severe service. It is an exceptionally rugged machine.

The complete unit is entirely self-contained—the frame is of the solid box type, heavily braced and ribbed and proportioned to give the maximum of strength and rigidity.

For driving these Hoists we furnish either Direct Current or Alternating Current Motors. The Controllers used are usually of the drum type as illustrated.

THE ENGLISH IRON WORKS CO.
Kansas City, Mo., U. S. A.

Wood & Co., R. D., Philadelphia, Penn.

Gas Purifiers
Wood & Co., R. D., Philadelphia, Penn.

Gears
Fawcus Machine Co., Pittsburgh, Penn.
Philadelphia Gear Works, 1120 Vine St., Philadelphia. Cable Address: "Philagear."
All sizes.
All descriptions gear cutting and wheels.
Stroh Steel-Hardening Process Co., Pittsburgh, Pa.

Gears, Bevel
Philadelphia Gear Works, 1120 Vine St., Philadelphia. Cable Address: "Philagear."

Gears, Cast
Cleveland Worm & Gear Co., Cleveland, Ohio.

Gears, Cut and Worm
Cleveland Worm & Gear Co., Cleveland, Ohio.

Gears, Double Helical
Caldwell & Sons Co., H. W., 17th St. and Webster Ave., Chicago.
Falk Co., The, Milwaukee, Wis.
Any face to 42 in.; diameter to 12 ft.
Staggered herringbone teeth with continuous tooth engagement. Machine-cut from solid blanks.
Fawcus Machine Co., Pittsburgh, Penn.

Gears, Rawhide
Philadelphia Gear Works, 1120 Vine St., Philadelphia. Cable Address: "Philagear."

Generators, Electric
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Graphite
Dixon Crucible Co., Joseph, Jersey City, N. J.

Grease
Dixon Crucible Co., Joseph, Jersey City, N. J.

Grease Cups
Lunkenheimer Co., The, Cincinnati, Ohio.

Grinders, Ore
Braun Corporation, The, Los Angeles, Calif.
Braun-Knecht-Heimann Co., San Francisco, Cal.
Laboratory machines for ore coke and coal.
Freese Co., E. M., Galion, Ohio.

Grinders, Sample
Denver Engineering Works Co., Denver, Colo.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Hammers, Power
Mayer Bros. Co., Mankato, Minn.
"Little Giant" power hammer with or without individual motor drive.

Head Frames, Mine
American Bridge Co., 30 Church St., New York.

Hoists, Electric
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Denver Engineering Works Co., Denver, Colo.
English Iron Works, Kansas City, Mo.
Flory Mfg. Co., S., Bangor, Penn.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Nordberg Mfg. Co., Milwaukee, Wis.
Ottumwa Iron Works, Ottumwa, Iowa.
Sizes 15 to 50 hp. in stock.
Traylor Engineering & Mfg. Co., Allentown, Pa.
Vulcan Iron Works, Wilkes-Barre, Penn.
Wellman-Seaver-Morgan Co., The, Cleveland, O.
Branches: New York and Denver, Colo.
Any size or capacity. Designed for any job. First or second motion.

Hoists, Gas and Gasoline
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.

Hoists, Oil
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.

Hoists, Portable
Chicago Pneumatic Tool Co., Chicago, Ill.
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
"Little Tugger"—for drill column, bar or timber mounting. It operates on air.
Mine & Smelter Supply Co., The, Denver, Colo.
Branches: Salt Lake City, El Paso, New York.

Hoists, Steam
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Danville Foundry & Machine Co., Danville, Ill.
English Iron Works, Kansas City, Mo.
Flory Mfg. Co., S., Bangor, Penn.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Nordberg Mfg. Co., Milwaukee, Wis.
Ottumwa Iron Works, Ottumwa, Iowa.
Sullivan Machinery Co., Chicago, Ill., U. S. A.
First motion Corliss and geared slide valve with automatic cut-off.
United Iron Works Company, Joplin, Mo.
Vulcan Iron Works, Wilkes-Barre, Penn.
Wellman-Seaver Morgan Co., The, Cleveland, O.

Hose, Air
Cleveland Rock Drill Co., Cleveland, Ohio.
All sizes.
Plain and wire wound in stock.
Denver Rock Drill Mfg. Co., Denver, Colo.
Wire wound, blue jacket and red jacket drill hose.
Goodrich Co., The B. F., Akron, Ohio.
Sizes ½" up.
Wrapped duck and braided fabric types. See "Commander." Resists injury through twists
Goodyear Tire & Rubber Co., The, Akron, Ohio.
Hardsocg Wonder Drill Co., Ottumwa, Iowa.
½", ¾", 1" plain and armored. Fitted with nipples and patent coupler.
Mine & Smelter Supply Co., The, Denver, Colo.
Branches: Salt Lake City, El Paso, New York.
Peerless Rubber Mfg. Co., 31 Warren St., N.Y.C.
Quaker City Rubber Co., 629 Market St., Phila., Pa.

Hose Clamps, Malleable
Knox Mfg. Co., 821 Cherry St., Philadelphia, Pa.

Houses, Steel Shaft
American Bridge Co., 30 Church St., New York.

Hydraulic Accumulators
Wood & Co., R. D., Philadelphia, Penn.

Idlers, Conveyor
Conveying Weigher Co., The, New York City.

Instruments, Surveying
Ainsworth & Sons, Wm., Denver, Colo.
Berger & Sons Co., C. L., Boston, Mass.
Buff & Buff Mfg. Co., Boston, Mass.
Transits, levels, current meters.

Insulating Materials, Electric
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Iron and Steel
Asbestos Protected Metal Co., Pittsburgh, Pa.
Asbestos protected, corrugated plates and shapes.

Jackets, Water
Traylor Engineering & Mfg. Co., Allentown, Pa.

Jigs
Denver Engineering Works Co., Denver, Colo.
Richards pulsator jigs and riffles.
James Ore Concentrator Co., Newark, N. J.
Traylor Engineering & Mfg. Co., Allentown, Pa.
United Iron Works Company, Joplin, Mo.

Kilns, Rotary
American Process Co., 68 William St., New York.

Laboratory Machinery
Braun Corporation, The, Los Angeles, Calif.
Braun-Knecht-Heinmann Co., San Francisco, Cal.
Denver Fire Clay Co., Denver, Colo., U. S. A.
Mine & Smelter Supply Co., The, Denver, Colo.
Branches: Salt Lake City, El Paso, New York.

Laboratory Supplies
Heil Chemical Co., Henry, St. Louis, Mo.

Lamps, Acetylene
Dewar Manufacturing Co., 28-30 35th St., Brooklyn, N. Y.
Simmons Co., John, 34 35th St., Brooklyn, N. Y.
Pioneer, Baldwin and Zar, cap and hand lamps, 3- to 12-hr. capacity.
Wolf Safety Lamp Co., 74 Washington St., N. Y.

Lamps, Electric
Edison Storage Battery Co., Orange, N. J. Factory and Main Office: Orange, N. J. Distributors in New York, Boston, Chicago, Detroit, San Francisco, Seattle, New Orleans.
Mine Safety Appliances Co., Pittsburgh, Penn.
The Edison electric safety mine lamps have received the approval of the U. S. Bureau of Mines under Schedule 6A for safety and for practicability and efficiency in general service.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Lamps, Safety Cap
Edison Storage Battery Co., Orange, N. J. Factory and Main Office: Orange, N. J. Distributors in New York, Boston, Chicago, Detroit, San Francisco, Seattle, New Orleans.
Mine Safety Appliances Co., Pittsburgh, Penn.
The Edison electric safety mine lamp uses the Edison nonacid storage battery. Strong, rugged, nonspillable and permanent in capacity. Approved by Bureau of Mines under Schedule 6A.

Lightning Arresters
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Line Material, Overhead
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Linings, Ball Mill
Traylor Engineering & Mfg. Co., Allentown, Pa.

Linings, Tube Mill
Hardinge Conical Mill Co., 120 Broadway, New
Traylor Engineering & Mfg. Co., Allentown, Pa.

Locomotives, Compressed Air
Porter Co., H. K., 1203 Union Bldg., Pittsburgh, Penn.

Locomotives, Electric
General Electric Co., Schenectady, N. Y.
Jeffrey Mfg. Co., The, 974 N. 4th St., Columbus, O.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Locomotives, Electric Storage Battery
Atlas Car & Mfg. Co., Cleveland, Ohio.
Edison Storage Battery Co., Orange, N. J. Factory and Main Office: Orange, N. J.
Edison nickel-iron-alkaline storage batteries for mine locomotives. Economy of upkeep and long life are distinguishing features.
General Electric Co., Schenectady, N. Y.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Locomotives, Gasoline
Vulcan Iron Works, Wilkes-Barre, Penn.
Whitcomb Co., Geo. D., Rochelle, Ill.

Locomotives, Industrial
American Locomotive Co., 30 Church St., N. Y.
Porter Co., H. K., 1203 Union Bldg., Pittsburgh, Penn.

Locomotives, Mine
American Locomotive Co., 30 Church St., N. Y.
Porter Co., H. K., 1203 Union Bldg., Pittsburgh, Penn.

Locomotive Parts
American Locomotive Co., 30 Church St., N. Y.

Locomotives, Steam
American Locomotive Co., 30 Church St., N. Y.
Porter Co., H. K., 1203 Union Bldg., Pittsburgh, Penn.
Branch: 30 Church St., New York.
Vulcan Iron Works, Wilkes-Barre, Penn.

Lubricants
Dixon Crucible Co., Joseph, Jersey City, N. J.

Lubricators
Whitcomb Co., Geo. D., Rochelle, Ill.

Lubricating Oils
Standard Oil Co., Chicago, Ill.

Magnetic Pulleys
Dings Magnetic Separator Co., 673 Smith St., Milwaukee, Wis.
Magnetic pulleys in all sizes. When used as head pulley in belt conveyor, it converts latter into magnetic separator. Will save machinery by throwing out unbreakable iron substances, such as hammer heads, etc.

Meters, Electric Current
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Metal, Asbestos Protected
Asbestos Protected Metal Co., Pittsburgh, Pa.

Metals and Alloys
Primos Chemical Co., Primos, Del. Co., Penn.
Cable: "Briquette, Phila." Branches: Vanadium and Lakewood, Colo.
Agents: Allan S. Davison & Co., Pittsburgh, Pa.

Metals, Noncorrosive
International Nickel Co., The, 43 Exchange Place, New York.
"Monel" metal. Tough, acid-resisting alloy. Rods, flats, castings, sheets, strips and wire.

Metals, Perforated
Erdle Perforating Co., Rochester, N. Y.
Harrington & King Perforating Co., The, 620 N. Union Ave., Chicago, Ill. Branch: 114 Liberty St., New York.
All sizes and shapes of perforations; all kinds and thicknesses of metals.
Screens for trommels, stamp mills, jigs, etc.
Hendrick Mfg. Co., Carbondale, Penn.

Mills, Ball, Tube and Pebble
Abbe Engineering Co., 22 Broadway, New York.
Chalmers & Williams, Chicago Heigths, Ill.
Cable Address: "Toman, Chicago."
Adjustable quick discharge.
Colorado Iron Works Co., Denver, Colo.
Denver Engineering Works Co., Denver, Colo.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Mine & Smelter Supply Co., The, Denver, Colo.
Branches: Salt Lake City, Utah; El Paso, Tex.; 42 Broadway, New York.
"Marcy" Ball Mills with patent discharge grate. Large capacity, small floor space.
Traylor Engineering & Mfg. Co., Allentown, Pa.
All sizes and capacities.

Mills, Chilean
Lane Mill & Machinery Co., Los Angeles, Calif.
Cable: "Lanemill."
Sizes: 5-, 7- and 10-ft. Capacities: 10, 20 and 40 tons per 24 hr.
"Slow-speed" Chilean mills, 20- and 40-ton mills can be sectionalized for transportation on pack animals.
Traylor Engineering & Mfg. Co., Allentown, Pa.
Wellman-Seaver-Morgan Co., The, Claveland, O.

Mills, Stamp
Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Colorado Iron Works Co., Denver, Colo.
Denver Engineering Works Co., Denver, Colo.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Traylor Eng. & Mfg. Co., Allentown, Penn.

Minerals and Ores, Rare
Ward's Natural Science Estab., Rochester, N. Y.

Molybdenum Ore, Buyers of
Primos Chemical Co., Primos, Del. Co., Pa. Cable: "Briquette, Phila." Branches Vanadiaum and Lakewood, Colo.
Agents: Allen S. Davison & Co., Pittsburgh, Pa.
Rose Chemical Co., Los Angeles, Calif.

Motors
General Electric Co., Schenectady, N. Y.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Motor Generator Sets
General Electric Co., Schenectady, N. Y.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

Motor Control
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.
For all types and capacities of motors.

Netting, Wire
Ludlow-Saylor Wire Co., St. Louis, Mo.
"Hex" poultry netting. Stack netting for locomotives.
Catalog No. 45.

Nickel
International Nickel Co., The, 43 Exchange Place, New York.

Oiled Clothing
Goodrich Co., The B. F., Akron, Ohio.
Sou'westers, jackets, apron pants. Rubber goods for abrasive wear.

Oils, Flotation (See "Flotation Oils")

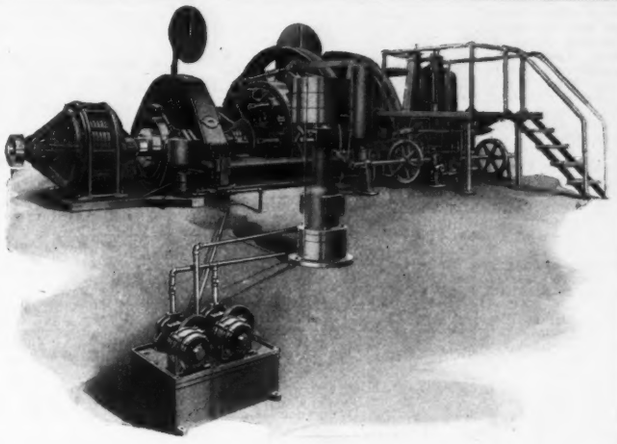
Ore, Buyers and Sellers of
American Metal Co., New York City. Agents: Campania des Minerales y Metales, Mexico City and Monterey; South American Metal Co., Santiago, Chile.
American Smelting & Refining Co., 120 Broadway, New York,
Agents: Kleinwort, Sons & Co., London, England; W. A. Price and Geo. J. Ewart, City of Mexico; F. D. Aller, Antofagasta, Chile.
wort, Sons & Co., London, England; W. A. Price and Geo. J. Ewart, City of Mexico; F. D. Aller, Antofagasta, Chile.
American Zinc, Lead & Smelting Co., 55 Congress St., Boston, Mass.
American Zinc & Chemical Co., Langeloth, Pa.
Arizona Copper Co., Clifton, Ariz.
Arkansas Zinc & Smelting Corp., 42 Broadway, New York.
Balbach Smelting & Refining Co., Newark, N. J.
Bartlesville Zinc Co., 52 Broadway, New York.
Beer, Sondheimer & Co., 61 Broadway, New

The photograph shows a large

Ottumwa Electric Hoist

built for the

Eagle & Blue Bell Mining Co.
Salt Lake City, Utah



The reels are 12 ft. in diameter and hold 2500 ft. of flat rope. Each reel is driven with axial plate clutch operated by thrust cylinder by means of oil under pressure. The brakes are of the post type, gravity applied and released by oil acting in thrust cylinder. The brakes are interlocked with the clutches and so arranged that the clutch can not be thrown out only when the brake is set, and the clutch is thrown in before the brake can be released. The gears are run in oil tight gear case. The hoist is equipped with overwinding device, which will apply the emergency brakes in case of overwind, overspeed or failure of current supply to the hoist.

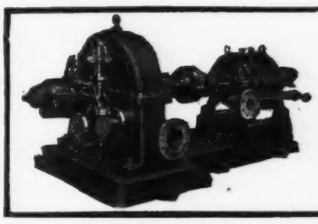
Let us quote you on your next hoist.

Ottumwa Iron Works, Ottumwa, Iowa

FRENIER'S SPIRAL PUMP
The most durable pump for elevating
TAILINGS, SLIMES, BATTERY SANDS, etc.
No Valves No Buckets
FRENIER & SON, Rutland, Vt.
AGENTS—Allis-Chalmers Co., Chicago, Ill. Stearns-Roger Mfg., Co., Denver, Col. Harron, Rickard & McCone, San Francisco, Cal. Frank R. Perrot, Perth, W. Australia.

How Much Does Your Air Cost You?
CONNERSVILLE ROTARY POSITIVE BLOWER
Especially designed for the economical and dependable delivery of air between ½ and 10 lbs. per sq. inch pressure for pulverized coal installations, flotation plants, smelter, cupola and furnace work. We are also prepared to quote on cyanide pumps. **Let us send literature.**
The Connersville Blower Co., Connersville, Ind.

Chas. C. Moore & Co., Engineers
San Francisco, Calif.
Complete Power Plants
Boilers, Engines, Condensers, Pumps, Hoists, Compressors, Heaters, Purifiers, Valves and all Power Plant Auxiliaries.



TURBINE PUMPS
giving maximum efficiency either belted, motor or steam turbine driven. Request Catalog "E."
Alberger Pump & Condenser Co.
140 Cedar St., New York City
Chicago St. Louis Philadelphia
Boston San Francisco S

DE LAVAL STEAM TURBINE CO.
TRENTON, N. J.
Builders of TURBINE MACHINERY, including Steam Turbines of all capacities for high or low-pressure steam and for direct connection, or for belt or rope drive. Complete Turbo-Generator Sets. Centrifugal Pumps for all Heads and Capacities. Centrifugal Blowers and Air Compressors.
Write for special bulletins on apparatus in which you are interested.

ROBT. HOLMES & BROTHERS, Inc., Successors to
Danville Foundry & Machine Co., DANVILLE, ILLINOIS.
The consolidation of these two large plants means the manufacture of a more varied and extensive line of mining and other machinery, doubling the facilities of the works.

Hydraulic Turbines
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Mill Drives . Turbine Transmissions
Spur Gears . Bevel Gears . Worm Gearing
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York. Branch: 1101 Newhouse Bldg., Salt Lake City, Utah.
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Blackwell Sons & Co., Ltd., Geo. G., The Albany, Liverpool, England.
Consolidated Mining & Smelting Co. of Canada, Ltd., The, Trail, British Columbia.
Ducktown Sulphur, Copper & Iron Co., Ltd., Isabella, Tenn.
Grasselli Chemical Co., The, Cleveland, Ohio.
Hardy, Charles, 50 Church St., New York.
Hegeler Zinc Co., The, Danville, Ill.
Illinois Zinc Co., Peru, Ill.
International Smelting Co., 42 Broadway, New York. Ore Purchasing Department: 621 Kearns Bldg., Salt Lake City, Utah. Smelting Works: International, Utah, and Miami, Ariz. Refineries: Raritan Copper Wks., Perth Amboy, N.J.; Internat. Lead Refining Co., E. Chicago, Ind.
Irvington Smelting & Refining Works, Irvington, N. J. Branch Office: New York.
Ladysmith Smelting Corp., Ltd., Vancouver, B. C.
Leavitt & Co., C. W., 30 Church St., New York.
Matthiessen & Hegeler Zinc Co., La Salle Ill.
Nichols Copper Co., 25 Broad St., New York.
See advertisement.
Ozark Mining Co., 601 Canal Rd., Cleveland, O.
Pass & Son, Ltd., Capper, Bristol, England.
Pennsylvania Smelting Co., Pittsburgh, Penn.
Phelps, Dodge Corp., New York City.
Seaboard Ore Sales Corp., 15 Broad St., N. Y. C.
St. Joseph Lead Co., 61 Broadway, New York.
United Metals Selling Co., 42 Broadway, New York. European Agents: C. S. Henry & Co., Ltd., 12 Leadenhall St., London, E. C.
See advertisement.
United States Smelting, Refining & Mining Co., 55 Congress St., Boston, U. S. A. Works: Midvale, Utah; Needles, Calif.; Gold Road, Ariz.; Kennett, Calif.; Chrome, N. J.; Grasselli, Ind.; Pachuca and Real del Monte, Mexico.
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Vogelstein & Co., L., 42 Broadway, New York.

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Ledoux & Co., Inc., 99 John St., New York.
Pitkin, Inc., Lucius, 47 Fulton St., New York.

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Goodrich Co., The B. F., Akron, Ohio.
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Goodyear Tire & Rubber Co., The, Akron, Ohio.
Peerless Rubber Mfg. Co., 31 Warren St., N.Y.C.

Packing, Rod

Peerless Rubber Mfg. Co., 31 Warren St., N.Y.C.

Packing, Sheet

Peerless Rubber Mfg. Co., 31 Warren St., N.Y.C.

Paint, Preservative

Dixon Crucible Co., Joseph, Jersey City, N. J.

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Atkins, Kroll & Co., San Francisco.
Encinitas Pebble Co., Box 1375, San Diego, Cal.
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Weigele Riveted Steel Pipe Works, Denver, Colo.

Pipe, Spiral Riveted

Abendroth & Root Mfg. Co., 45 Bway., New York.

Pipe, Steel

National Tube Co., Pittsburgh, Penn.

Pipe, Wood

National Tank & Pipe Co., Portland, Ore.
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Redwood Mfrs. Co., San Francisco, Calif.

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Aetna Explosives Co., 2 Rector St., New York.

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Traylor Engineering & Mfg. Co., Allentown, Pa.

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Highland Chemical Products Co., Connellsville, Penn.

Preservative, Wood (See "Creosote")

Presses, Filter

Shriver & Co., T., 826 Hamilton St., Harrison, N.J.
United Filters Corp., Felt Bldg., Salt Lake City, Utah.

Presses, Hydraulic

Wood & Co., R. D., Philadelphia, Penn.

Publishers, Technical Book

McGraw-Hill Book Co., Inc., 239 W. 39th St., New York. Branches: London and Berlin.

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Traylor Engineering & Mfg. Co., Allentown, Pa.

Pulverizers, Ore

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Laboratory machines for all purposes and prospecting.
Braun-Knecht-Heinmann Co., San Francisco, Cal.
Mine & Smelter Supply Co., The, Denver, Colo.
Branches: Salt Lake City, El Paso, New York.
Traylor Engineering & Mfg. Co., Allentown, Pa.

Pumping Engines

Allis-Chalmers Mfg. Co., Milwaukee, Wis.
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.

Pumps, Boiler Feed

Cameron Pump Works, 11 Bway., New York.
Deming Co., The, Salem, Ohio.
Worthington Pump & Mchy. Corp., 115 Broadway, New York.

Pumps, Centrifugal

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Chemical Pump & Valve Co., Perth Amboy, N. J.
De Laval Steam Turbine Co., Trenton, N. J.
Deming Co., The, Salem, Ohio.
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.
Krogh Pump Mfg. Co., San Francisco, Calif.
Wood & Co., R. D., Philadelphia, Penn.
Worthington Pump & Mchy. Corp., 115 Broadway, New York.

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Deming Co., The, Salem, Ohio.
United Iron Works Company, Joplin, Mo.

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Cameron Pump Works, 11 Bway., New York.
Deming Co., The, Salem, Ohio.
Krogh Pump Mfg. Co., San Francisco, Calif.
Roots Co., P. H. & F. M., Connersville, Ind.
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Wood & Co., R. D., Philadelphia, Penn.
Worthington Pump & Mchry. Corp., 115 Broadway, New York.

Pumps, Mill

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Deming Co., The, Salem, Ohio.
Frenier & Son, J. H., Rutland, Vt., U. S. A.
Krogh Pump Mfg. Co., San Francisco, Calif.
Roots Co., P. H. & F. M., Connersville, Ind.
Traylor Engineering & Mfg. Co., Allentown, Pa.
United Iron Works Company, Joplin, Mo.
Worthington Pump & Mchry. Corp., 115 Broadway, New York.

Pumps, Pneumatic Air Lift

Sullivan Machinery Co., Chicago, Ill., U. S. A.

Pumps, Power Plant

Alberger Pump & Condenser Co., New York City.
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Deming Co., The, Salem, Ohio.
Roots Co., P. H. & F. M., Connersville, Ind.

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Deming Co., The, Salem, Ohio.
Hazard Mfg. Co., Wilkes-Barre, Penn.
Krogh Pump Mfg. Co., San Francisco, Calif.

Pumps, Vacuum

Abbe Engineering Co., 22 Broadway, New York.
Alberger Pump & Condenser Co., New York City.
Cameron Pump Works, 11 Bway., New York.
Doak Gas Engine Co., 503 Market St., San Francisco, Calif.
Ingersoll-Rand Co., 11 Broadway, New York.
Roots Co., P. H. & F. M., Connersville, Ind.

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Emerson Steam Pump Co., The, Alexandria, Va.

Punches, Hydraulic

Wood & Co., R. D., Philadelphia, Penn.

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Beer, Sondheimer & Co., Inc., 61 Broadway, N. Y.

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Sweet's Steel Co., Williamsport, Penn.

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Wood & Co., R. D., Philadelphia, Penn.

Rolls, Crushing (See "Crushers")

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Hazard Mfg. Co., Wilkes-Barre, Penn.
Leschen & Sons Rope Co., A., St. Louis, U. S. A. N. Y., Chi., Denver, Salt Lake, San Francisco.
Roebling's Sons Co., John A., Trenton, N. J.
Waterbury Co., 63 Park Row, New York. Branches: Chi., San Francisco, New Orleans, Boston. Agent: Powell & Ellet Co., Dallas, Tex.

Rules, Measuring

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Braun-Knecht-Heimann Co., San Francisco, Cal.
Denver Engineering Works Co., Denver, Colo.
Hendrie & Bolthoff M. & S. Co., Denver, Colo.
Mine & Smelter Supply Co., The, Denver, Colo.
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Traylor Engineering & Mfg. Co., Allentown, Pa.

Scales, Conveyor

Conveying Weigher Co., The, New York City.

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James Ore Concentrator Co., Newark, N. J.
Traylor Engineering & Mfg. Co., Allentown, Pa.

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MacGovern & Co., 114 Liberty St., N. Y. City.
Morse Bros. Mach. & Supply Co., Denver, Colo.
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See Alphabetical Index for For Sale Ads.

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Magnetic separators for all purposes.

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Grasselli Chemical Co., The, Cleveland, Ohio.
Illinois Zinc Co., Peru, Ill.
International Smelting Co., 42 Broadway, New York.
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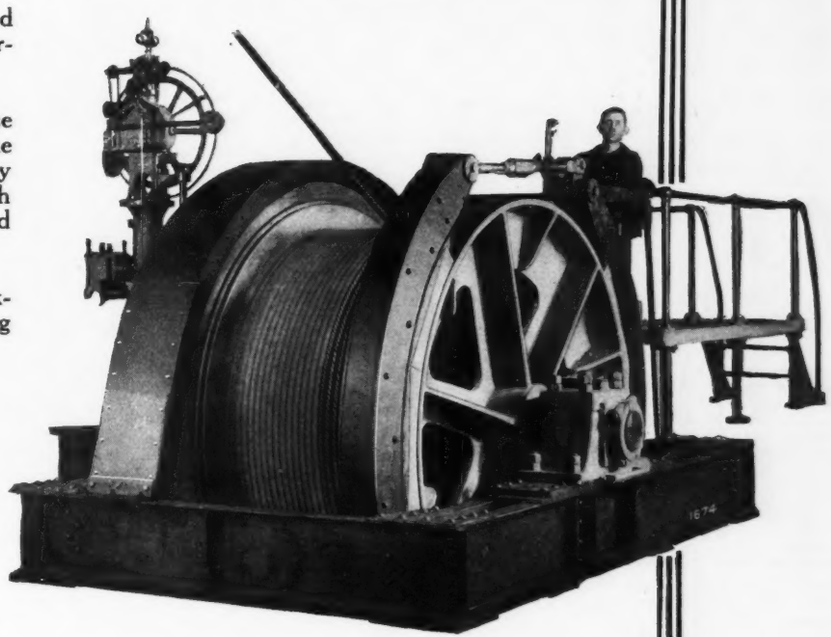

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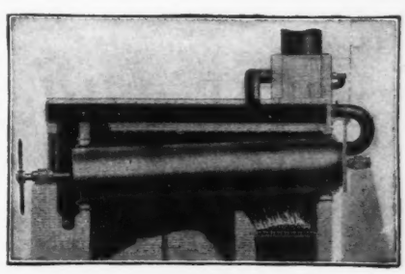

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Iron-clad magnetic equipment compactly assembled in cast-iron box to protect it.

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Up to 350 mesh.

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Riblet Tramway Co., Spokane, Wash., U. S. A.
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Allis-Chalmers Mfg. Co., Milwaukee, Wis.
De Laval Steam Turbine Co., Trenton, N. J.
General Electric Co., Schenectady, N. Y.
Leffel & Co., James, 306 Lagonda St., Springfield, Ohio, U. S. A.
Westinghouse El. & Mfg. Co., E. Pittsburgh, Pa.

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Homestead Valve Mfg. Co., Homestead, Penn.
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Whitcomb Co., Geo. D., Rochelle, Ill.

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Chemical Pump & Valve Co., Perth Amboy, N. J.
Lunkenheimer Co., The, Cincinnati, O., U. S. A.
Wood & Co., R. D., Philadelphia, Penn.

Valves, Gate
National Tube Co., Pittsburgh, Penn.
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See "Oxyacetylene Apparatus."

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Sanford-Day Iron Co., Knoxville, Tenn.

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Up to 350 mesh.

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Atkins, Kroll & Co., San Francisco, Calif.
New Jersey Zinc Co., 55 Wall St., New York.
Vogelstein & Co., L., 42 Broadway, New York.

Zinc, Sheet
Grasselli Chemical Co., The, Cleveland, Ohio.
Illinois Zinc Co., Peru, Ill.
Matthiessen-Hegeler Zinc Co., La Salle, Ill.

This Index

is an up-to-the-minute record of NEW Equipment for the metal mining and metallurgical industries. When you are in the market for SECOND-HAND Equipment, consult the

"SEARCHLIGHT" SECTION

It appears immediately following the last text pages.

The Searchlight Section is devoted exclusively to the advertising of Employment, Equipment and Business Opportunities among metal mines and metallurgical establishments. It is the recognized medium of communication between mine operators, employers and employees.

If you don't find what you want in this issue of the Searchlight advertise for it in the next one. You will find the response immediate and satisfactory and the cost small.

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Geared or First Motion
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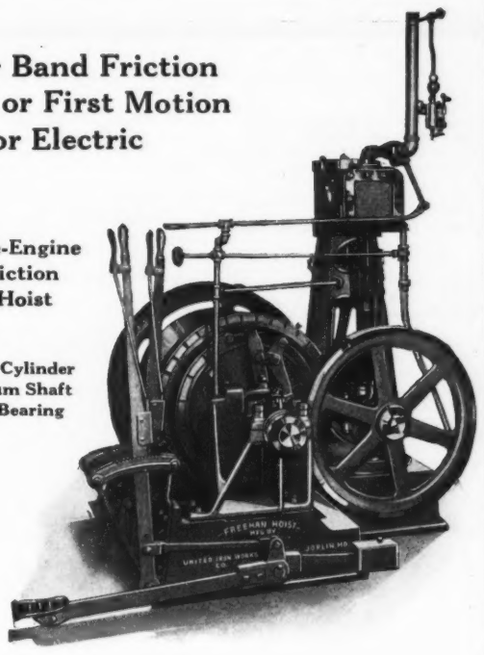

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Outboard Bearing

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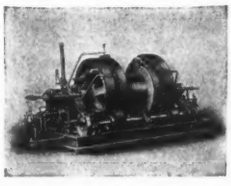

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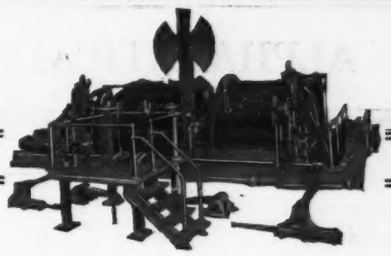

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VULCAN HOISTS

ALPHABETICAL INDEX TO ADVERTISEMENTS

	Page
Abbe Engineering Co.	54
Abendroth & Root Mfg. Co.	43
Aetna Explosives Co.	44
Ainsworth & Sons Co., Wm.	56
Alberger Pump & Condenser Co.	75
Allis-Chalmers Mfg. Co.	33
American Bridge Co.	44
American Locomotive Co.	50
American Metal Co., Ltd.	62
American Process Co.	44
American Sheet & Tin Plate Co.	42
American Smelting & Refining Co.	63
American Steel & Wire Co.	42
American Zinc & Chemical Co.	61
American Zinc, Lead & Smelting Co.	61
Arizona Copper Co.	56
Arkansas Zinc & Smelting Corp.	60
Armstrong Mfg. Co.	43
Asbestos Protected Metal Co.	54
Atlas Car & Mfg. Co.	50
Bacon, Earle C.	55
Baker & Co., Inc.	56
Balbach Smelting & Refining Co.	57
Bartlesville Zinc Co.	57
Bartlett & Snow Co., C. O.	77
Beach & Co.	58
Beer, Sondheimer & Co., Inc.	63
Blackwell Sons Co., Geo. G.	77
Bemis Bro. Bag Co.	19
Berger & Sons, C. L.	56
Bogue Supply Co.	40
Braun Corporation, The	55
Braun-Knecht-Heimann Co.	55
Broderick & Bascom Rope Co., 3rd cover	
Buchanan Co., Inc., C. G.	54
Buff & Buff Mfg. Co.	55
Business Men's Clearing House.	36
Butchart, W. A.	26
Caldwell & Son Co., H. W.	46
Caldwell Co., Inc., W. E.	43
Cameron Steam Pump Works, A. S.	15
Cement-Gun Co.	43
Chalmers & Williams	32
Chemical Pump & Valve Co.	73
Chicago Perforating Co.	73
Chicago Pneumatic Tool Co.	46
Cleveland Rock Drill Co.	3
Cleveland Worm & Gear Co.	79
Colorado Iron Works Co.	11, 29
Connersville Blower Co.	75
Consolidated Mining & Smelting Co. of Canada	61
Conveying Weigher Co., The	46
Danville Fdry. & Mach. Co.	75
Davis-Bournonville Co.	49
Deister Concentrator Co.	13
Deister Machine Co.	5
De Laval Steam Turbine Co.	75
Denver Engineering Works Co.	7
Denver Fire Clay Co.	27
Denver Rock Drill Mfg. Co.	17
Dewar Mfg. Co.	49
Diamond Drill Carbon Co.	80
Dings Magnetic Separator Co.	28
Directory of Engineers	64
Dixon Crucible Co., Joseph	45
Dorr Co.	44
Ducktown Sulphur, Copper & Iron Co., Ltd.	58
Dwight & Lloyd Sintering Co., Inc.	42
Easton Car & Construction Co.	52
Edison Storage Battery Co.	51
English Iron Works Co.	73
Enterprise Fdry. & Mach. Wks.	52
Falk Co., The	79
Fawcus Co.	75
Federal Motor Truck Co.	31
Flory Mfg. Co., S.	79
For Sale Ads	37, 41
Freese & Co., E. M.	42
Frenier & Son	75
Gandy Belting Co.	46
Garlock Packing Co.	45
General Chemical Co.	27
General Electric Co.	35
General Naval Stores Co.	55
Georgia Pine Turpentine Co. of New York	55
Goodrich Rubber Co., B. F., 4th cover	
Goodyear Tire & Rubber Co.	24, 25
Grasselli Chemical Co., The	62
Greene, Tweed & Co.	44
Gregory Electric Co.	48
Harbison-Walker Refractories Co.	56
Hardsocg Wonder Drill Co.	28
Hardy, Chas.	57
Harrington & King Perforating Co., The	71
Harris Bros.	39
Hazard Mfg. Co.	42
Hegeler Zinc Co.	58
Heil Chemical Co., Henry	56
Hendrick Mfg. Co.	73
Hendrie & Bolthoff Mfg. & Supply Co.	4
Highland Chemical Products Co.	54
Illinois Zinc Co.	58
Indiana Laboratories Co.	58
Industrial Works	50
Ingersoll-Rand Co.	14, 15
International High-Speed Steel Co.	7
International Nickel Co.	58
International Smelting Co.	59
Irvington Smelting & Refining Works	60
James Ore Concentrator Co.	55
Kent Mill Co.	55
Knox Mfg. Co.	45
Krogh Pump Mfg. Co.	73
Ladysmith Smelting Corp., Ltd.	58
Lane Mill & Machinery Co.	55
Leavitt & Co., C. W.	60
Ledoux & Co., Inc.	60
Leffel & Co., Jas., The	73
Leschen & Sons Rope Co., A.	42
Lidgerwood Mfg. Co.	77
Longyear Co., E. J.	48, 49
Ludlow-Saylor Wire Co.	6
Lufkin Rule Co.	56
Lunkenheimer Co.	45
Matthiessen & Hegeler Zinc Co.	61
Mayer Bros. Co.	48
MacGovern & Co.	39
McGraw-Hill Book Co.	53
McKiernan-Terry Drill Co.	48
Milne & Co., A.	73
Mine and Smelter Supply Co., The	10
Mitsui & Co., Ltd.	63
Monarch Engineering & Mfg. Co.	47
Moore & Co., Engineers, C. C.	75
Morse Bros. Machinery & Supply Co.	54
Multi-Metal Separating Screen Co.	42
National Tank & Pipe Co.	43
National Tube Co.	43
New Jersey Zinc Co.	58
New York Engineering Co.	48
Nichols Copper Co.	77
Norwalk Iron Works Co.	46
Osgood Co., The	49
Ottumwa Iron Works Co., Inc.	75
Ozark Smelting & Mining Co., The	57
Pass & Son, Ltd., Capper	58
Peerless Rubber Mfg. Co.	22
Pennsylvania Drilling Co.	48
Pennsylvania Smelting Co.	58
Pensacola Tar & Turpentine Co.	55
Phelps, Dodge Corp.	58
Philadelphia Gear Works	12
Pitkin, Lucius, Inc.	60
Porter Co., H. K.	50
Positions Vacant and Wanted	36
Primos Chemical Co.	60
Pruden Co., C. D.	42
Robins Conveying Belt Co.	46
Roeblings' Sons Co., John A.	42
Roessler & Hasslacher Chemical Co.	60
Roots Co., P. H. & F. M.	73
Ruggles-Coles Eng. Co.	44
St. Joseph Lead Co.	56
Sanford-Day Iron Works	52
Scaife & Sons Co., W. B.	45
Schieren Co., Chas. A.	46
Seaboard Ore Sales Corp.	58
Searchlight Section 36, 41	
Second-Hand Equipment, 37, 38, 39, 40, 41	
Senn Concentrator Co.	23
Shriver & Co., T.	48
Smith Co., S. Morgan	75
Smooth-On Mfg. Co.	45
Southwestern Engr. Co., Inc.	30
Standard Oil Co.	47
Stephens-Adamson Mfg. Co., 2nd cover	
Stroh Steel-Hardening Process Co.	47
Stromberg-Carlson Telephone Mfg. Co.	41
Sullivan Machinery Co.	8
Traylor Engineering & Mfg. Co., 3rd cover	
Union Construction Co.	48
United Filters Corp.	16
United Iron Works Co.	79
United Metals Selling Co.	59
United States Smelting, Refining & Mining Co.	62
Universal Road Machinery Co.	55
Vogelstein & Co., Inc.	57
Vulcan Iron Works (Wilkes-Barre)	79
Want Ads.	36
Waterbury Co.	42
Watt Mining Car Wheel Co.	52
Webb City & Carterville Foundry & Mach. Works	54
Wedge Mechanical Furnace Co.	9
Wellman-Seaver-Morgan Co.	18
Westinghouse Elec. & Mfg. Co.	34
What and Where To Buy (English)	70
Whitcomb Co., G. D.	50
Wood & Co., R. D.	26
Wood Equipment Co.	52
Worthington Pump & Machinery Corp.	20, 21
Yuba Mfg. Co.	1st cover 48

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